

N. RANDALL KELLY

Report of the
Bureau of Engineering
1927-1928

Department of Public Works
City and County of
San Francisco
M. M. O'SHAUGNESSY
City Engineer

SAN FRANCISCO HISTORY ROOM



SAN FRANCISCO
PUBLIC LIBRARY

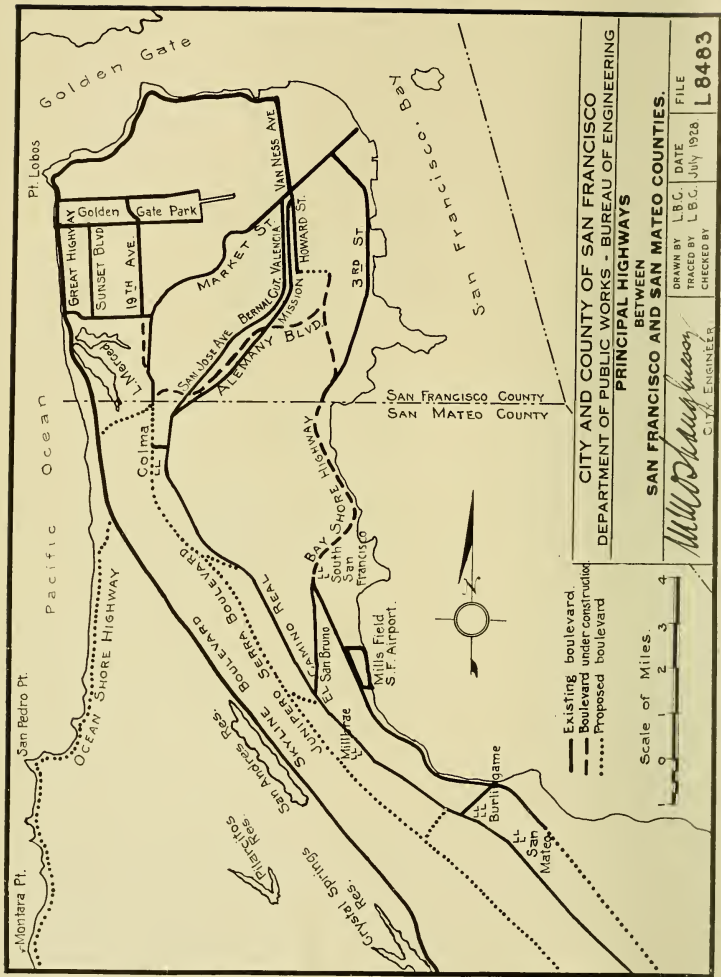
SAN FRANCISCO PUBLIC LIBRARY



3 1223 03529 8075

REFERENCE BOOK

Not to be taken from the Library



CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC WORKS - BUREAU OF ENGINEERING

PRINCIPAL HIGHWAYS
BETWEEN

SAN FRANCISCO AND SAN MATEO COUNTIES.

DRAWN BY	L.B.C.	DATE	FILE
TRACED BY	L.B.C.	July 1928	L 8483
CITY ENGINEER	W. D. Harrison	CHECKED BY	

REPORT
OF THE
BUREAU *of* ENGINEERING

OF THE
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF
SAN FRANCISCO

•—•
FISCAL YEAR ENDED JUNE 30, 1928
•—•

JAMES ROLPH, Jr. » » » Mayor

TIMOTHY A. REARDON
CHARLES E. STANTON
FRED W. MEYER

Board of Public Works

M. M. O'SHAUGHNESSY
City Engineer

X 352.5
52522
(1927-28)

Report of the Bureau of Engineering

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF SAN FRANCISCO
1927-1928

To the Honorable
The Board of Public Works of the
City and County of San Francisco.

Gentlemen:

I transmit herewith the annual report of the Bureau of Engineering for the fiscal year ended June 30, 1928.

Boulevard construction authorized by the bond election of November, 1927, has begun. Actual work on Bernal Cut, authorized in the election of June 14, 1927, seems assured now that the Supervisors have approved an agreement for exchange of lands with the Southern Pacific Company. Satisfactory progress has been made in the formation of the Islais Creek Reclamation District. Legal obstacles delaying construction of the Judah Street Railway have been removed and it is expected that cars will be in operation in October, 1928. A substantial addition has been made to the High Pressure Fire Protection System. Fair progress has been made in sewer construction but appropriations by the Supervisors, as for years past, continue to be inadequate. A newly organized Traffic Division has undertaken much to facilitate vehicular traffic in our streets. Extensive airport improvements have been made and a future plan developed.

In the Hetch Hetchy Water Supply System, operation of the Mountain Division, Moccasin Power Plant and Bay Development continue satisfactorily. Construction is progressing rapidly in both the Foothill Division and the Coast Range Division.

It is with pleasure that I note that the electorate has approved the issuance of \$24,000,000 worth of bonds to complete the Hetch Hetchy Aqueduct and \$41,000,000 to purchase the system of the Spring Valley Water Company, this latter question having been an issue before the citizens since 1875.

Again I must express my appreciation of the efforts and loyal assistance of the subordinates in this department, especially Nelson A. Eckart, Chief Assistant, having direct charge of Hetch Hetchy and other public utilities, Clyde E. Healy, Second Assistant, in charge of streets and sewers construction and local improvements, and Paul J. Ost, Electrical Engineer, in charge of power and railway engineering. I am indebted to L. B. Cheminant, Assistant Engineer, assisted by Leo Glick, for the preparation and compilation of this report.

Respectfully,

San Francisco,
August 30, 1928.

M. M. O'SHAUGHNESSY,
City Engineer.



Digitized by the Internet Archive
in 2013

CONTENTS

	Page
LETTER OF TRANSMITTAL.....	i
EMPLOYEES OF BUREAU OF ENGINEERING, 1928.....	vii
BOULEVARDS, STREETS AND HIGHWAYS.....	1
Bay Shore Boulevard	2
Alemany Boulevard	4
Junipero Serra Boulevard	4
Nineteenth Avenue	8
Sunset Boulevard	8
Ocean Beach Esplanade	8
Great Highway	8
Van Ness Avenue Extension	10
Ocean Shore Highway	10
Bernal Cut Boulevard	11
Market Street Extension	11
Laguna Honda Boulevard	13
Roosevelt Way	14
Teresita Boulevard	14
Merced Lands Panhandle	14
Golden Gate Park Panhandle Extension.....	14
Miscellaneous Street Construction	15
Widening Streets	15
Special Treatment Improvements	17
TRAFFIC, SIGNS AND MARKERS.....	21
Traffic Engineering	21
Traffic Markers	21
Street Signs	23
SPECIAL PROJECTS AND INVESTIGATIONS.....	24
Islais Creek Reclamation District.....	24
San Francisco Bay Bridges	25
STRUCTURES AND MISCELLANEOUS CONSTRUCTION.....	26
Sunset Tunnel	26
Broadway Tunnel	28
San Francisco Municipal Airport	29
Auxiliary Water Supply System Extension.....	32
Municipal Water Works Extension.....	33
Maintenance of Bridges	35
SEWERS	37
Current Construction	37
Sewers Planned	41
Necessity for Sewer Bond Issue.....	41
Side Sewers	42
STREET WORK PERFORMED UNDER CONTRACT.....	44
STREET IMPROVEMENT ASSESSMENTS, ETC.....	46
SURVEYS	47
RAILWAYS	50
Unified Transportation System	50
Franchises	53
Extensions to Municipal Railway System.....	54
Sunset Line	60

CONTENTS—(Continued)

	Page
RAILWAYS—(Continued)	
Embarcadero Bus Line	60
Marina Bus Line	61
Car Shops and Garage	61
Material Yard	62
West Portal Avenue	62
Equipment	62
CURRENT CONTRACT DATA	63
HETCH HETCHY WATER SUPPLY.....	67
Progress and Development	67
Organization and Headquarters Work.....	68
Field Headquarters	70
Relations with Department of Interior.....	72
Mather Recreation Camp	77
Automobile Tourist Camp	77
Hetch Hetchy Railroad	77
Storage Reservoirs	77
Aqueduct—Mountain Division	78
Moccasin Division	78
Power System Operation	79
Early Intake Plant Operation	79
Moccasin Plant Operation	81
Transmission Line Bond Issue	82
Aqueduct Foothill Division	82
Hetch Hetchy Junction Shops	82
Moccasin Re-Regulating Reservoir	82
Tunnel Driving	83
Tunnel Lining from Hetch Hetchy Junction.....	88
Tunnel Lining from Rock River	90
Tunnel Lining from Moccasin Portal	90
Aqueduct, Coast Range Division	90
Livermore Headquarters	91
Surveys	91
Right of Way Acquisitions	92
Roads	92
Camp Water Supplies	93
Power for Construction Purposes	93
Seco Substation	94
Transmission Lines	95
Camp Substations	96
Telephone System	96
Tunnel Construction	97
Bay Development and Peninsular Reservoirs.....	106
City Reservoirs	106
The Spring Valley Purchase	106
Peninsular Water Supply Investigations.....	108
Hetch Hetchy Water Supply Contracts in Force during Fiscal Year 1927-1928	109
Financial Statement, Hetch Hetchy Project.....	110

ILLUSTRATIONS AND DIAGRAMS

Page

PRINCIPAL HIGHWAYS BETWEEN SAN FRANCISCO AND SAN MATEO COUNTIES—MAP	Frontispiece
BAY SHORE BOULEVARD	
Heavy Cut in Rock	3
Subgrade Ready for Pavement	3
ALEMANY BOULEVARD	
Concrete Road Finisher	5
Finished Concrete Base	5
BOULEVARDS UNDER CONSTRUCTION THROUGH BOND	
ISSUE OF 1927—SECTIONS	6
OCEAN BEACH ESPLANADE	
Map and Sections	7
General View of Construction	9
Construction of Bleachers	9
LAGUNA HONDA BOULEVARD—Map and Sections.....	12
ROOSEVELT WAY	13
SPECIAL TREATMENT IMPROVEMENT	
Vermont Street between 20th and 21st Streets.....	16
Holladay Avenue from Peralta Avenue to Adam Street.....	18
Montgomery Street north of Green Street.....	19
TRAFFIC SIGNAL	22
BROADWAY TUNNEL—Plan, Profile and Section.....	27
MILLS FIELD, SAN FRANCISCO MUNICIPAL AIRPORT—	
Hangar No. 2.	29
ISLAIS CREEK STORM SEWER	36
LAGUNA HONDA BOULEVARD SEWER	38
WESTERLY SUNSET DISTRICT SEWER	39
FILLMORE STREET SEWER	39
WAWONA STREET SEWER	40
HETCH HETCHY TRANSMISSION LINE	
Power Line Towers at Crossing of San Joaquin River.....	80
HETCH HETCHY AQUEDUCT—Foothill Division	
Moccasin Re-regulating Reservoir, Moccasin Creek By-pass	
Conduit	83
Tunnel Progress Chart	89
HETCH HETCHY AQUEDUCT—Coast Range Division	
Seco Substation	94
Tesla Portal	98
Thomas Shaft	98
Mitchell Shaft	99
Mitchell Shaft Camp	99
Mocho Shaft and Camp	101
Indian Creek	
Shaft and Camp	101
Hoist and Compressor	103
Crosscut at Shaft	103
Crosscut South for Future Tunnel.....	104
Crosscut North and Beginning of Tunnel Construction.....	104
HETCH HETCHY PROJECT—Costs of Labor and Materials, Num- ber of Men Employed, Annual and Total Expenditures, Charts....	120



EMPLOYEES OF BUREAU OF ENGINEERING

1928

M. M. O'SHAUGHNESSY.....	City Engineer
N. A. Eckart.....	Chief Assistant Engineer—Utilities, Tunnels
C. E. Healy.....	Second Assistant City Engineer—General City Engineering

General Office:

W. A. Smith.....	Engineering Draftsman
A. W. Garbarino.....	Field Assistant
J. F. Hourigan	Chauffeur
Mrs. A. M. Osswald	Stenographer
Miss K. F. Sears	Stenographer
Miss A. Kelly	Stenographer

Special Assignments:

M. J. Bartell.....	Hydraulic Engineer
L. B. Cheminant.....	Engineering Draftsman
F. E. Hackney	Engineering Draftsman

Design: Structures, Sewerage, Tunnels, Special Improvements, High Pressure System, Boulevards, etc.

W. H. Ohmen.....	Engineering Draftsman—in charge
M. H. Levy.....	Assistant Civil Engineer
L. J. Archer	Engineering Draftsman
B. A. Baird	Engineering Draftsman
A. V. Bowhay.....	Engineering Draftsman
W. N. Buckley	Engineering Draftsman
M. J. Callaghan	Engineering Draftsman
Jas. E. Dillon	Engineering Draftsman
J. C. Gard.....	Engineering Draftsman
J. O. Hanson.....	Engineering Draftsman
A. M. Johnson	Engineering Draftsman
M. D. Johnson	Engineering Draftsman
C. V. Patterson	Engineering Draftsman
F. L. Schultz.....	Engineering Draftsman
L. G. Tegtmeier.....	Engineering Draftsman
A. V. Adler	Structural Draftsman
S. D. Arnold	Structural Draftsman
U. G. Brown.....	Structural Draftsman
V. B. Christensen	Structural Draftsman
W. S. Hassenmiller	Structural Draftsman
N. F. Newman.....	Structural Draftsman
R. B. Redington.....	Structural Draftsman
J. J. White.....	Structural Draftsman
R. D. Wichman	Structural Draftsman
A. L. Auradou.....	Cartographer
C. C. Clifton	Inspector
R. L. Phillips	Inspector
F. A. Sullivan	Inspector
Rodney Surryhne	Inspector
A. V. Walker.....	Inspector

Street Improvement Design:

J. M. Owens.....	Engineering Draftsman—in charge
E. A. Burke	Surveyor
C. J. Manelli.....	Engineering Draftsman
H. L. Reinfeld	Engineering Draftsman
J. J. Schlappi	Engineering Draftsman
T. C. Ronan	Field Assistant

Street Improvement Investigation and Permits:

W. C. Pidge.....	Assistant Civil Engineer
L. R. Mercado	Inspector
E. I. Titlow.....	Inspector

Street Improvement Assessments, Complaints, etc.:

E. E. Jordan.....	Surveyor—in charge
Office:	
W. H. McCarthy	Inspector
L. C. Whaley	Inspector
Israel Schwartz.....	Clerk
Miss Mae Sullivan.....	Stenographer

Field:

S. P. Duckel.....	Inspector
A. A. Flynn	Inspector
E. E. McCartney	Inspector
Philip Williams	Inspector
W. A. Lewis.....	Inspector

Street Grades:

G. F. Stahle.....	Surveyor—in charge
W. A. Smith, Jr.....	Field Assistant

Surveys:

H. J. Stahle.....	Surveyor—in charge
Office:	
C. H. Stern.....	Surveyor
*A. D. Phares.....	Surveyor
I. J. Ohman.....	Assistant Civil Engineer
R. H. Owens.....	Engineering Draftsman
John L. Slater, Jr.....	Engineering Draftsman
A. J. Abrahamsen	Field Assistant
E. J. Cullen	Inspector
Roger McCarthy.....	Field Assistant
Howard Miller	Field Assistant

Field:

J. F. Coughlan	Surveyor
W. H. Eggert	Surveyor
Ivan Flamm	Surveyor
E. A. Garen	Surveyor
Clifford Jones	Surveyor
F. W. Knox	Surveyor
W. T. Lundy.....	Surveyor
John Schlotzhauer	Surveyor
R. G. Banks.....	Field Assistant
H. R. Brook.....	Field Assistant
S. B. Carlson.....	Field Assistant
G. R. Code	Field Assistant
C. C. Dennis.....	Field Assistant
J. W. Farnham.....	Field Assistant
L. E. Fenton.....	Field Assistant
**J. H. Flynn.....	Field Assistant
J. C. Garbarino.....	Field Assistant
C. A. Gardiner	Field Assistant

*Died September 17, 1927.

**Died March 5, 1928.

Surveys:**Field—(Continued) :**

N. A. Giberson	Field Assistant
Raymond Grier	Field Assistant
W. J. Hatman	Field Assistant
C. S. Hiden	Field Assistant
D. R. Hult	Field Assistant
Wm. F. Kaiser	Field Assistant
Carl O. Markle	Field Assistant
R. L. McHugh	Field Assistant
Germain W. Miller	Field Assistant
T. E. Moroney	Field Assistant
Chas. J. Muller	Field Assistant
Andrew Olson	Field Assistant
J. M. Smithwick	Field Assistant
John Smithwick	Field Assistant

Traffic Engineering:

G. D. Burr	Traffic Engineer—in charge
Geo. L. Tobin	Engineering Draftsman

Electrical and Street Railway Engineering:

P. J. Ost	Electrical Engineer—in charge
A. B. Johns	Assistant Electrical Engineer
Axel W. Olsen	Assistant Electrical Engineer
O. M. Prince	Assistant Mechanical Engineer
Wm. C. Eggert	Electrical Draftsman
L. M. Perrin	Electrical Draftsman
C. A. Hoffman	Engineering Draftsman
L. Constine	Inspector
L. V. Degnan	Inspector
W. S. Levin	Inspector

Mechanical Engineering—H. H. W. S. Project:

*E. P. Jones	Mechanical Engineer
--------------------	---------------------

Hydraulic and Civil Engineering—H. H. W. S. Project:

**R. P. McIntosh	Hydraulic Engineer
L. W. Stocker	Assistant Civil Engineer—in charge
Ray L. Allin	Hydraulic Engineer
M. L. Dickinson	Hydraulic Engineer
T. T. Knappen	Hydraulic Engineer
W. W. Helbush	Assistant Mechanical Engineer
Eugene Burjan	Engineering Draftsman
A. J. Duttke	Engineering Draftsman
R. B. Hansen	Engineering Draftsman
H. Homberger	Engineering Draftsman
E. D. Howe	Engineering Draftsman
J. H. Meursinge	Engineering Draftsman
J. H. Turner	Engineering Draftsman
R. H. Williams	Engineering Draftsman
N. F. Yde	Engineering Draftsman
John D. Hatch	Architectural Draftsman
E. P. Cutting	Cartographer
L. C. Stiles	Cartographer

*Retired February 1, 1928.

**Died January 27, 1928.

General Office—H. H. W. S.—Purchasing, Correspondence, etc.

H. W. Kephart.....	Stenographer-Bookkeeper—in charge
Fred Head	Clerk
L. Cederberg	Stenographer
Florence A. Edwards	Stenographer
Wm. E. Hull.....	Stenographer
Mildred Hurlbut	Stenographer
Minne McKenna	Stenographer
Rose Strohmaier	Stenographer

Lands and Rights of Way Purchases:

J. J. Phillips.....	Right of Way Agent—in charge
E. J. Riordan.....	Engineering Draftsman
C. M. Fanning.....	Engineering Draftsman

Chemical and Testing Laboratory:

C. L. Cook.....	Engineering Chemist—in charge
Peter Bernard	Assistant Engineering Chemist

Blueprinting and Photography:

H. B. Chaffee.....	Photographer—in charge
H. Adami	Photostat Operator
H. B. Dodge	Blueprinter
John Houlihan	Blueprinter

Meteorological Investigations:

E. E. Eklund.....	Meteorologist—in charge
H. S. Messersmith.....	Computer

Construction—Local:

F. O. Shutts.....	Assistant Civil Engineer—Supervising Street and Sewer Construction
C. M. Taylor.....	Inspector—Supervising Major Projects
F. J. Sheehan.....	Assistant Mechanical Engineer—Super- vising Street Railway Construction

Office:

Leo Glick	Assistant Civil Engineer
V. M. Tanner.....	Engineering Draftsman
J. A. Ducray	Inspector
S. A. Grant.....	Inspector

Field:

J. C. Foss, Jr.....	Hydraulic Engineer
J. J. Casey	Engineering Draftsman
C. J. Geertz	Engineering Draftsman
J. O. Meyerink.....	Engineering Draftsman
G. F. Mitchell.....	Engineering Draftsman
E. F. Muheim.....	Engineering Draftsman
F. J. O'Shaughnessy	Engineering Draftsman
G. W. Purser	Engineering Draftsman
Wm. Anderson	Inspector
W. S. Balk	Inspector
Thos. Breslin	Inspector
F. D. Brown.....	Inspector
E. R. Bunting.....	Inspector
J. D. Coon	Inspector
J. J. Crowley.....	Inspector
L. T. Curran.....	Inspector
L. DeCew	Inspector

Construction—Local:**Field—(Continued) :**

W. T. Duffy.....	Inspector
Wm. Fisher	Inspector
A. J. Furderer.....	Inspector
E. L. Gartland.....	Inspector
J. H. Hanly	Inspector
J. S. Heilmann.....	Inspector
Chas. P. Huff.....	Inspector
S. M. Jarrett.....	Inspector
Jas. Kazan	Inspector
Thos. J. Keenan.....	Inspector
Frank Keville	Inspector
H. J. Law.....	Inspector
F. J. Lewis.....	Inspector
A. P. Mallon.....	Inspector
P. D. McCarthy.....	Inspector
J. F. McMullen.....	Inspector
W. S. Merrill.....	Inspector
Thos. P. Mullaney.....	Inspector
P. C. O'Dowd.....	Inspector
John Oller.....	Inspector
Geo. J. Partridge.....	Inspector
L. J. Pope.....	Inspector
J. A. Rademann.....	Inspector
R. B. Reed.....	Inspector
D. T. Ryan.....	Inspector
Wm. Ryan	Inspector
I. A. Sankey.....	Inspector
A. L. Scroggy.....	Inspector
*Theo. Tominski.....	Inspector
W. C. Wanderer.....	Inspector
D. Wardin	Inspector
J. B. West.....	Inspector
W. H. Williams, Jr.....	Inspector
J. L. Saunders.....	Field Assistant
F. F. Buhr.....	Hoisting Engineer

Construction—H. H. W. S. Project:**Foothill Division :**

L. T. McAfee.....	Construction Engineer—in charge
L. A. McAtee.....	Assistant Engineer
A. J. Wehner.....	Assistant Engineer
J. H. Harwood.....	Assistant Engineer
H. E. Meyer.....	General Foreman
J. V. Devine.....	Master Mechanic
J. P. Degnan.....	Physician
W. O'Brien	Accountant

Coast Range Division:

C. R. Rankin	Construction Engineer
--------------------	-----------------------

Power Operation:

Thornton Easler.....	Assistant Electrical Engineer—in charge
Douglas Mirk.....	Chief Operator—Moccasin Power House
C. G. Dorman.....	Chief Operator—Intake Power House

*Retired December 1st, 1927.



BOULEVARDS, STREETS AND HIGHWAYS

The increase in use of automobiles has brought with it a demand for more and better roadways, not only the streets for local use but broad, well paved arteries for commercial traffic and boulevards to points of scenic interest both within the City and in the neighboring counties.

Prior to San Francisco's "Great Fire" of 1906, but little consideration was given to boulevards within the City. But two thoroughfares, Van Ness Avenue and Golden Gate Avenue, were then paved with asphaltic surface. The automobile was just beginning its influence for better roadways.

The Burnham plan, developed about 1906, sponsored by public spirited citizens, proposed establishment of broad, arterial streets and in many places the establishment of new streets on better grades than those in the existing checker board system. Due to the chaotic conditions subsequent to the Fire, the plan was dropped, altho the devastation of a portion of the City would have made its consummation easier. Street reconstruction went on as funds permitted, under no well ordinated plan.

In 1913, this department, under M. M. O'Shaughnessy, as City Engineer, formulated a complete boulevard plan and mapped out a program for its gradual development. Without special taxation or special appropriations the system has been gradually completed, having been financed almost entirely by funds received from the state tax on automobiles and gasoline, amounting then to less than \$100,000 annually, but now approaching \$1,000,000 and aggregating twelve million dollars.

The 1913 program included construction of the Marina Boulevard, a 100-foot thoroughfare 4500 feet long from Laguna Street to Lyon; Hunter's Point Boulevard, 80 feet wide and 10,300 feet long from Third Street to Hunter's Point; Twin Peaks Boulevard, 40 feet wide and two miles long from Clayton Street to Portola Drive, encircling Twin Peaks at 900 feet elevation; Market Street Extension, 70 feet wide, extending 7200 feet from Seventeenth Street to Twenty-fourth Street and Portola Drive which leads to Ingleside; Sloat Boulevard, 135 feet wide, and two miles in length from Portola Drive to the Ocean Beach; and Bernal Cut, 117 feet wide and 4200 feet long.

This program has been completed excepting the last unit, the Bernal Cut. Issuance of bonds to provide funds for the improvement of the Cut was authorized June 14, 1927, as noted in the last annual report.

While the 1913 program was being carried through, there was a tremendous increase in the use of automobiles and with it a strong demand for additional traffic facilities. The demand was not only for streets in the City, but also for avenues of approach to the suburban areas in San Mateo County, which were the more popular because travel to and from the counties north and east is throttled by the delays and inconvenience of ferry travel.

The City Engineer therefore proposed the boulevard bond issue of \$9,380,000 for the construction of 15.62 miles of highway as outlined in the last annual report. This bond issue was authorized November 8, 1927, by the vote: For, 92,867; Against, 25,638. On November 26, the City Engineer requested that funds be made available as follows:

Feb. 1, 1928	\$2,500,000
July 1, 1928	2,500,000
Jan. 1, 1929	2,500,000
July 1, 1929	1,880,000
Total.....	<hr/> \$9,380,000

This would allow completion of the boulevards as planned, including paving, by June, 1930, allowing sufficient periods of time for fills to settle in the interim.

In accordance with the City Engineer's recommendation the first block of bonds was sold on February 27, 1928, and preparations are well forward for the sale of the second block.

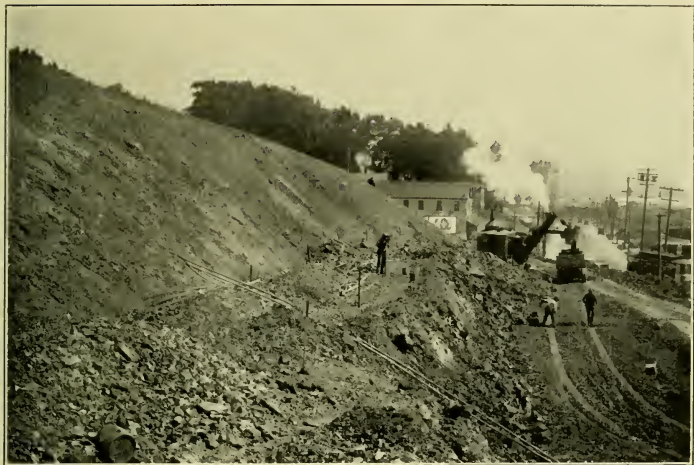
Bay Shore Boulevard from Potrero Avenue to the County Line, a distance of 3.01 miles, will consist of a 100-foot roadway with sidewalks 12.5 feet wide. The State is about to receive bids for extension of this highway southerly from the County Line to South San Francisco, a distance of about 3.5 miles, for approximately \$700,000. The City's work is divided for construction purposes into five sections, A, B, C, D. and E, and these again in some cases, into separate contracts.

Section A extends from Potrero Avenue to Silver Avenue, a distance of 6,000 feet. Contract No. 1 for this section was awarded on June 11, 1928, to L. J. Cohn for the estimated price of \$224,347.98 for grading, sewer, pavement, etc. Work has been begun. A second contract, later on, will cover the construction of pavement on portions of the above where new fill is being made and permanent pavement cannot now be placed. This section should be ready for use about January, 1929.

Section B extends from Silver Avenue to Paul Avenue, a distance of 3719 feet. The construction of this section is being done under one contract awarded March 2, 1928, to Federal Construction Company in the estimated amount of \$139,909.58, and due to be completed in December, 1928.

Section C, 2119 feet long, from Paul Avenue to Third Street, will be done under two contracts, neither of which has been yet awarded on account of difficulty in acquiring the numerous parcels of land necessary for the improvement.

Section D, 1600 feet long from Third Street to Tunnel Avenue near San Bruno Avenue will be constructed under one contract of the estimated value of \$237,000. This contract should be let during August.



Heavy cut in rock



Subgrade ready for pavement
BAY SHORE BOULEVARD

Section E, 2500 feet long, from Tunnel Avenue to the San Mateo County Line, will be constructed under one contract, estimated at \$138,000. This also has been delayed on account of property acquisition.

At the intersection of Bay Shore and Alemany Boulevard, a storm drain to carry the flow of Islais Creek is being constructed out of boulevard funds under a contract awarded March 2, to L. J. Cohn in the estimated amount of \$59,594.40. Work is 35 per cent complete and should be finished in September. The drain is a reinforced concrete conduit 484 feet long, consisting of two compartments each 8 feet 6 inches by 11 feet, and resting on piles from 60 to 85 feet long, set four to a bent, with bents at 2 feet 3 inches center to center. The heavy foundation is used to give the drain sufficient bearing power to support an industrial spur track that is planned for the future.

Alemany Boulevard has been divided into six sections. This boulevard is 100 feet wide, with 80-foot roadway and two 10-foot sidewalks.

Section A, 7100 feet long, extends from Bay Shore Boulevard to Mission Street. Plans are under preparation.

Section B, 3900 feet long, from Mission Street to Ocean Avenue, will be constructed under two contracts. The first of these was awarded March 10, 1928, to Eaton & Smith for the estimated amount of \$106,763.41. The work is 42 per cent complete and should be finished by October. The second contract will be for the permanent paving of the portions of Contract No. 1 that are on fills which must be allowed one season for proper settlement.

Section C, 7800 feet long from Ocean Avenue to San Jose Avenue will be constructed under two contracts. Acquisition of necessary properties is not yet complete.

Section D, from San Jose Avenue to Orizaba Avenue, a distance of 1630 feet, will probably not be constructed for some time, on account of the heavy expense of boulevard and railway grade separation, but for the present the boulevard will be routed over Section D1 along Sickles Avenue and Sagamore Street, a distance of 2300 feet, to Orizaba Avenue. Contract for this latter work, for the estimated sum of \$58,500 should be let in September.

Section E, from Orizaba Avenue to Junipero Serra Boulevard, a distance of 2710 feet, will be built under two contracts estimated at \$75,000 and \$50,000, respectively, which should be awarded in August. Properties are now being acquired.

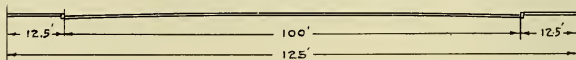
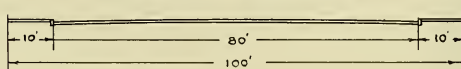
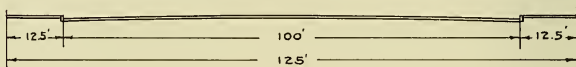
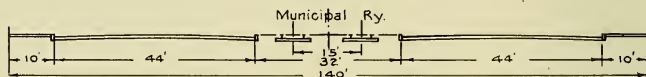
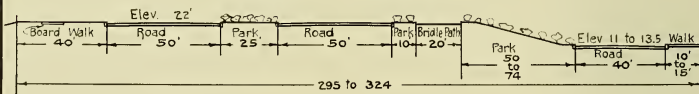
Junipero Serra Boulevard as now existing is a 25-foot paved roadway on a 45-foot right of way. The new plans provide for a 100-foot pavement and two 12½-foot sidewalk areas for a length of 1.80 miles from the intersection of Portola Drive with Sloat Boulevard to the San Mateo County Line. The work will be done under two contracts on which the estimates aggregate \$600,000. Negotiations for rights of way have de-



Concrete Road Finisher



Finished Concrete Base
ALEMANY BOULEVARD

BAY SHORE HIGHWAY**ALEMANY BOULEVARD****JUNIPERO SERRA BOULEVARD****NINETEENTH AVENUE****GREAT HIGHWAY**

CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC WORKS - BUREAU OF ENGINEERING

**BOULEVARDS UNDER CONSTRUCTION
THROUGH BOND ISSUE OF 1927.**

Wm. H. Ayres
CITY ENGINEER

DRAWN BY L.B.C.
TRACED BY L.B.C.
CHECKED BY

DATE
June 6,
1928.

FILE
L8344.

layed actual construction and it is expected that contracts will be awarded in October.

An extension of the Junipero Serra Boulevard 12 miles long to Burlingame, known at present as the **Bi-county Highway**, is contemplated by co-operation of San Francisco and San Mateo Counties as a joint highway district. Plans are maturing rapidly for construction of the $3\frac{1}{2}$ -mile section from the County Line southerly and southeasterly to a junction with El Camino Real between Lawndale and San Bruno, beyond the so-called "bottleneck."

Nineteenth Avenue will be extended southerly from its intersection with Sloat Boulevard, along a 100 foot right of way with 80 feet of pavement and two 10-foot sidewalk areas, to an intersection with the Municipal Railway right of way. Here the boulevard widens to 140 feet of right of way, of which the railway occupies the central 32 feet. Two roadways, each 44 feet wide, will straddle the railway strip, with 10-foot sidewalk areas next the outer property lines. This plan will continue to an intersection with the new Junipero Serra Boulevard at Worcester Avenue.

Acquisition of rights of way is practically complete, plans have been prepared, and it is expected that bids will be received in October.

This work will be done under three contracts aggregating \$442,000. The first contract will include all grading and all pavement in cut. After the fills have settled they will be paved under the second contract. The third contract covers reconstruction of about 2300 feet of 18-inch cast iron pipe sewer, which will be relaid along the edge of the pavement.

Sunset Boulevard involves only acquisition of a strip of land 240 feet wide, from Golden Gate Park to Sloat Boulevard, under this bond issue. To date \$66,041.50 has been spent for this purpose. The total estimated value of lands to be bought is \$1,900,000.

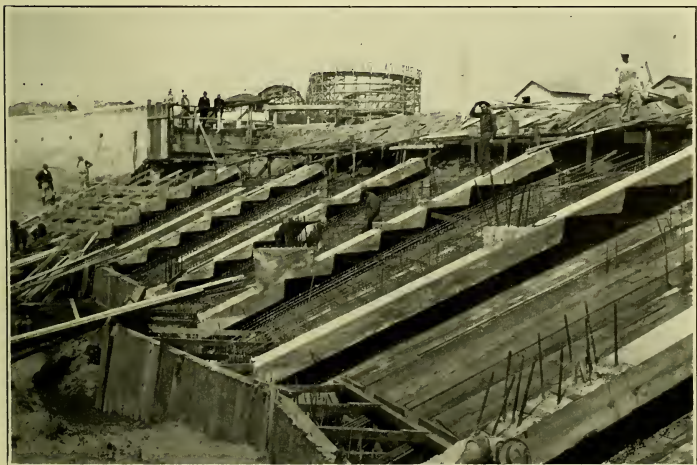
Ocean Beach Esplanade construction has proceeded satisfactorily. Owing to the fact that no lands nor rights of way had to be purchased, this work was under way in advance of other items included in the Boulevard Bonds.

Contract No. 1 for construction of 2232 feet of Esplanade along the Ocean frontage of Golden Gate Park was awarded on March 2, 1928, to Healy-Tibbitts Construction Company for the estimated amount of \$329,948. A second contract for the estimated sum of \$90,000 will later on be entered into for paving the adjacent area. The width of roadway varies from 188 to 199 feet. The present contract should be completed by April, 1929. This will give a finished length of 4298 feet of concrete Esplanade from Sutro Heights to the southerly line of Golden Gate Park.

Great Highway is being improved from Lincoln Way to Sloat Boulevard, a distance of 2 miles. This development consists of a board walk fronting the Ocean Beach, two 50-foot roadways separated by a 25-foot



General view of new construction, showing completed
Esplanade and Cliff House in distance



Construction of Bleachers
OCEAN BEACH ESPLANADE

parked strip; a parked strip varying in width around 100 feet and including a 20-foot bridle path; a future lower roadway 40 feet wide in the east side and a sidewalk varying in width from 10 to 15 feet. Two new pedestrian underpasses will be provided, one at Judah Street near the Ocean Terminus of the new Municipal car line and one at Taraval Street. Bids will be received July 11, 1928, for Contract No. 1, on which the engineer's estimate is \$154,694.50, covering grading, temporary macadam pavement 8 inches in thickness with oiled wearing surface, drainage, lighting, underpasses, etc. A second contract, to be let in about a year, will include construction of permanent pavement, which will be black base 3½ inches thick and with 1½-inch wearing surface, placed on top of the temporary macadam. Estimated cost of Contract No. 2 is \$220,000.

Van Ness Avenue Extension, the eighth and last item in the \$9,380,000 bond program, calls for an expenditure of \$500,000 for the purchase of property necessary to extend this 125-foot avenue 0.16 mile from Mission Street to Howard Street at Thirteenth Street. No final action has yet been taken by the Supervisors on the City Engineer's recommendations for location and alignment of the extension.

In this boulevard construction, permanent pavement is being laid only where the roadway is in cut and offers no chance for settlement. For all jobs except the Great Highway, in which black base will be used, the permanent pavement consists of an 8-inch concrete base with 1½ inches of asphaltic binder and 1½ inches of asphaltic concrete wearing surface.

The asphaltic wearing surface and binder are of the thickness and grade that have proven most satisfactory for the conditions in this City.

The concrete specifications have been revised to fix the amount of cement at 6 sacks per cubic yard of finished concrete, to especially stress the quality and grading as to size of the rock and sand, and to fix a definite water content.

These modifications of specifications together with an increase of thickness of concrete base from 6 inches to 8 inches, are resulting in pavement of better quality than has heretofore been laid in San Francisco.

In fills or other places liable to settlement a temporary macadam pavement 8 inches thick with oiled surface is laid now, with its surface at such elevation that it will serve as a base for the concrete which will be laid after the fill is thoroughly compacted by a season or more of weathering.

In all boulevards under construction conduits are being installed for lighting and for the various traffic signals, and electroliers are being erected.

In addition to the main boulevards above mentioned, it is now planned to give San Francisco another main outlet to the south by the construction of the tri-county **Ocean Shore Highway**, which will extend from Junipero Serra Boulevard across the Skyline Boulevard and thence

down the coast generally along the line of the abandoned Ocean Shore Railway, to Santa Cruz, a distance of 76 miles. This highway will have a width of 40 feet on a 100-foot right of way and will be built on easy grades. Preliminary estimate of cost is \$5,300,000, which will be borne largely by San Francisco with minor assistance from San Mateo and Santa Cruz Counties. Steps are now being taken toward the formation of a joint highway district comprising the three counties.

Bernal Cut Boulevard plans have been completed and it is contemplated that the work be done in two contracts.

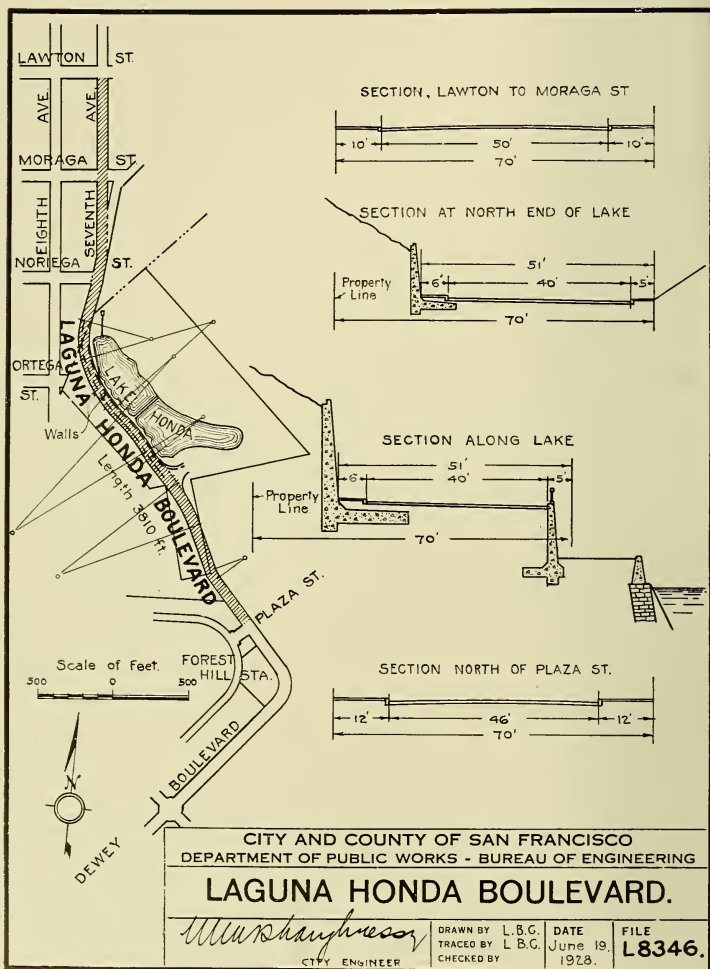
Contract No. 1 includes the removal of all bridge structures within the boundaries of the project, notably the arch structure now carrying the Southern Pacific tracks over Bosworth Street, the vehicular bridges over the railroad at Charles Street, and the foot-bridge and pipe bridge at Fairmont Street. A new bridge of concrete girder type will be constructed at Bosworth Street to carry the double tracks of the Southern Pacific Company, the double tracks of the proposed Municipal Railway extension, a 42-foot vehicular roadway and an 8-foot sidewalk. Estimated cost of this bridge is \$220,000. A concrete vehicular bridge, estimated cost of which is \$40,000, will be built across the cut to connect Highland Avenue to Arlington Street. A third bridge, estimated to cost \$11,000, will be built for pedestrian traffic from Richland Avenue to Miguel Street. The water main supplying College Hill Reservoir will cross the cut underground in the form of an inverted siphon.

The contract will also include grading and construction of walls, stairways, sewers, pavement and coping and necessary electrical work at a total cost of approximately \$550,000. Permanent pavement will be placed on portions of the roadway that are in cut and temporary pavement on the portion that is to be constructed on fill. It is estimated at this time that bids will be received by the middle of September, 1928. It will take approximately \$570,000 for completion of this work.

Contract No. 2 will provide for final permanent pavement on that portion that was temporarily paved under Contract No. 1 and should not be entered into less than one year after the completion of Contract No. 1. This will cost approximately \$20,000.

Contract No. 1 could have been let and work begun except for the delay occasioned by the Supervisors in failing to authorize the Mayor to enter into an agreement for exchange of lands with the Southern Pacific Company, which now operates a rail line at the site.

Market Street Extension, Section B, from Mono Street to Ord Street, on which grading, concrete walls, etc., were completed early in the year, has been paved with asphaltic concrete. The portion of the pavement on heavy fills is of a temporary nature and consists only of an asphaltic wearing surface over a macadam base. This extension 2200 feet long consists of a 54-foot roadway and two 8-foot walks. It con-



nects to the south with Section C, a 46-foot roadway on a 70-foot right of way 3450 feet long, extending to Twenty-fourth Street, which has been completed for several years.

From Twenty-fourth Street southerly and westerly the Market Street extension is known as **Portola Drive**. This is at present a narrow, winding, paved roadway for 3360 feet until it opens out to a paved width of 130 feet. During the year, 500 lineal feet of this wide pavement has been laid to meet tract improvements adjacent thereto. Plans are complete for widening the narrow pavement to 80 feet, with two 10-foot sidewalks, and for improving the alignment. In advance of the letting of a contract for this work fill is being placed where necessary as fast as material is available. The estimated cost of this work complete is \$153,500.

Laguna Honda Boulevard is an important crosstown arterial link from Seventh Avenue in the Sunset District to Forest Hill, whence there are connections to Portola Drive and the main boulevards to the south. At present there is a narrow strip of temporary pavement along Laguna Honda, a distributing reservoir of the Spring Valley Water Company. This department has been striving for several years to secure an appropriation for improving this roadway to proper alignment and sufficient width, and plans for the work were completed about three years ago, but



ROOSEVELT WAY

so far, funds for the entire project have not been provided. An essential preliminary is the construction of a sewer, which is now under way, as noted elsewhere in this report. It is to be hoped that the boulevard construction may follow immediately upon completion of this preliminary work.

The plans contemplate a roadway along the westerly edge of the lake, well above high water so as to allow future increase of reservoir capacity. This is the most important reservoir supplying San Francisco with water and all precautions must be taken for its purification. Extensive walls are required both to elevate the road above the lake and to prevent slides from the steep sand hill on the west. The right of way will be 70 feet wide for a length of 3,810 feet. Except for the section along the lake, two sidewalks are planned, varying from 12 feet to 6 feet in width. On the lake section, there will be but one walk 6 feet wide. Roadway varies from 50 feet at Lawton Street to 40 feet along the lake and 46 feet at Plaza Street near Forest Hill Station. Provision is made for a future main outlet from Sutro Forest to take care of traffic when this land shall have been subdivided for residential purposes. Estimated cost of Laguna Honda Boulevard, inclusive of present sewer construction contract, is \$225,600.

Roosevelt Way is a boulevard 3900 feet long and 60 feet wide, extending from Fourteenth and Alpine Streets to Seventeenth and Clayton Streets. In the annual report for 1925-1926 it was noted that the grading and walls were completed and temporary paving laid. During the year, permanent paving has replaced the temporary pavement in all places, thus completing the paving of the entire boulevard.

Teresita Boulevard, 70 feet wide, extending from Portola Drive to Melrose Street in the Sunnyside District west of the proposed Glen Park Reservoir, a length of about 6200 feet, is not only a useful crosstown route but gives the Westwood Park vicinity a satisfactory route downtown via Market Street extension. About 3500 feet of this boulevard has already been dedicated to public use and the City holds deeds to the remainder. The northerly end connects to the constructed part of Laguna Honda Boulevard, which now terminates at Plaza Street near Forest Hill Station.

Merced Lands Panhandle—a connection between Alemany Boulevard and the boulevard proposed to encircle the Merced lands now being purchased by the City from the Water Company, has been projected along Stanley Street, from Junipero Serra Boulevard to Orizaba Avenue. An estimate of \$200,000 has been made as the cost of the property to be acquired for the extension. The plans provide for a "Panhandle" connection 2400 feet long and 300 feet wide.

Golden Gate Park Panhandle Extension—an extension of Golden Gate Park Panhandle from Baker Street to Market Street near Duboce Avenue has been under discussion for years. This extension is highly

desirable as it would give a wide and almost level roadway to relieve the very heavy traffic that is constantly passing between Market Street and the Mission District on the east and Sunset and Richmond Districts on the west. Studies indicate that for this extension 4600 feet long and 200 feet wide, practically \$3,000,000 will be required.

Miscellaneous Street Construction.

While the construction of boulevards occupies a more striking place in the public view, of no less importance is the paving of local streets.

In addition to the above enumerated major highway projects, there has been almost the usual volume of street development work throughout the City. The marked increase of work noted last year has been checked temporarily by the slight business depression but again the greater portion of the work has been in the southerly and southwesterly parts of town and in the residential areas west of Twin Peaks where the usual amount of pavement, sewer, sidewalks, etc., has been placed.

The most noticeable units are Noriega Street and Forty-seventh Avenue with some adjacent blocks, totaling 6500 lineal feet of pavement, and Twenty-eighth Avenue from Judah Street to Pacheco Street, with adjacent blocks, totaling 9000 lineal feet. These and other paving units through the sand dunes of the Sunset District are quickly reclaiming this desert for residential use. Added impetus has been given to the work of paving by the construction of the Westerly Sunset Sewer, Section B, which will be described elsewhere.

Development of single blocks of pavements and of sewers has been pronounced in the Lakeview District, the valley of Islais Creek from Ocean View to Mission Viaduct, and around the rapidly developing industrial area in the Bay View District. The completion of the widening and paving of Turk Street from Masonic Avenue to Willard Street has provided a very popular artery from the Western Addition to the Richmond District.

Widening Streets:

In addition to the new boulevard and highway construction, the facilities for handling traffic have been increased by the widening of many of the main streets and connecting arteries between districts. Additional traffic lanes have been added to the roadways by cutting down sidewalk widths.

The widening of **San Jose Avenue** to 80 feet, begun several years ago, has been completed. This avenue is now a favorite artery for Peninsular automobile traffic, much of which is now diverted from Mission Street.

A similar improvement on **Noriega Street** from Twenty-first Avenue to Forty-eighth Avenue has been carried on during the year. This street, traversing the center of the Sunset District on easy grades, was originally dedicated 80 feet wide and laid out for 50-foot roadway and 15-



SPECIAL TREATMENT IMPROVEMENT
Vermont Street between Twentieth and Twenty-first Streets



foot sidewalks. Through co-operation of the property owners, 7 feet has been added to each side of the street so that now the street consists of a 70-foot roadway and two 12-foot sidewalks.

Parker Avenue from Euclid Avenue to California Street, a distance of about 725 feet, originally a 60-foot street with a 30-foot roadway carrying two street railway tracks, has been improved by dedication of an additional 14 feet on the east side. The sidewalk widths have been reduced to 12 feet so the new roadway is 50 feet wide, allowing ample room for street cars and vehicular traffic.

In many places the widening of roadways is a continuation of work begun in previous years. On Pine Street, 68 feet 9 inches wide, the roadway has been widened to 44 feet 9 inches from Mason Street to Leavenworth Street, a distance of 1375 feet, by setting back the curbs 3 feet on each side; Haight street from Fillmore Street to Baker Street, over 2800 feet, and Hayes Street from Franklin Street to Laguna Street, 1375 feet, have been treated similarly. Both O'Farrell and Ellis Streets, from Van Ness Avenue to Franklin Street, have acquired additional width of roadway, which has been given by a similar sidewalk narrowing, to carry their traffic to Franklin Street and reduce congestion on Van Ness Avenue. Some years ago, sidewalks on Geary Street as far west as Van Ness Avenue, were cut to 12 feet, the minimum for a business district. From Van Ness Avenue for eleven blocks or 5200 feet westerly through residential areas to Divisadero Street, the sidewalks are now being reduced to 10 feet, giving a roadway of 48 feet 9 inches. The same change is being made on Presidio Avenue from California Street to Geary Street, 5 blocks or 1550 feet.

Plans have been completed for widening the dangerously narrow entrance of Clayton Street at Market Street and are under way for widening Stanyan Street along the easterly line of Golden Gate Park from Oak Street to Frederick Street.

Studies have been made and plans are under way for the widening of Silver Avenue from 43½ feet to 60 feet from San Bruno Avenue to Quesada Avenue and for its extension therefrom to Palou Avenue, a total length of 3000 feet at an estimated cost of \$55,000.

Plans are under consideration for the widening of Van Ness Avenue and of Potrero Avenue.

Special Treatment Improvements:

These improvements were defined in the last annual report as requiring more than the ordinary treatment of local street improvements. During the year the department has had under consideration many of these projects, some of which have carried over from the preceding year. They are shown in tabular form as follows:

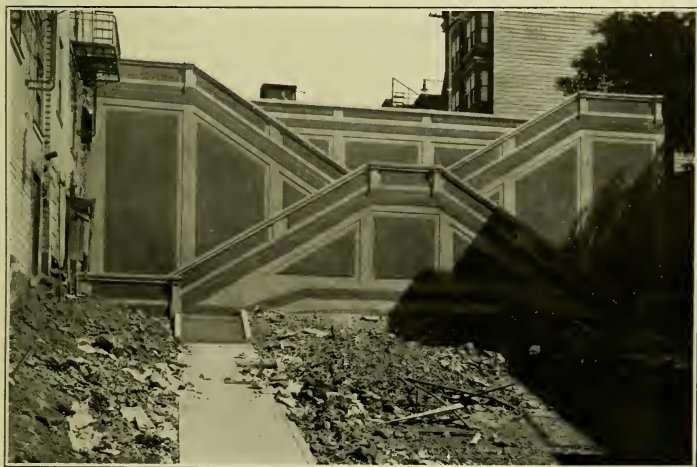


SPECIAL TREATMENT IMPROVEMENT
Holladay Avenue from Peralta Avenue to Adam Street
before and after improvement





SPECIAL TREATMENT IMPROVEMENT
Montgomery Street northerly from Green Street
before and after improvement



Improvement			
Construction Under Way or Completed During the Year:	Length Ft.	Width Ft.	Approx. Cost
Golden Gate Heights:			
Grading, Walls, Stairs, Macadam.....	4½ mi.	variable	\$425,000
Peralta Ave., York to Montcalm:			
Grading, Walls, Macadam.....	1,000	60	33,000
Holladay Ave., Peralta to Adam:			
Grading, Walls, Pavement.....	800	60	45,000
Vermont St., 20th to 22nd Sts.:			
Grading, Walls, Macadam.....	1,210	80	35,000
Castro St., 29th to 30th Sts.:			
Grading, Walls, Macadam.....	1,000	112' 6"	20,000
Florence St., Broadway to Vallejo:			
Walls,, Stairs, Pavement.....	275	30	7,000
Grand View Avenue:			
Grading, Walls, etc., complete, Paving, etc. Contract No. 2.....	2,350	44	38,000
Montgomery St., Green to Union:			
Grade, Pave, Sewers, Walls, Steps, etc.....	275	62' 5"	15,000
Pedestrian Underpasses:			
(2) Fleishhacker Pool			14,500
Plans Complete:			
Pedestrian Underpasses:			
Market St. in Congested Traffic Dist. (4)	125	8 x 12	135,000
Clayton St. Widening at Market St.....			21,000
Burnside Ave., Bosworth to Chenery St:			
Pavement, Steps, etc.....	212	60	7,760
Glen Park Terraces, Bosworth to Congo St:			
Pavement, Sewers, etc.....			36,000
Ingerson Ave., Ingalls to Griffith St.:			
Pavement, Walls, Steps, etc.....	1,508	80	49,000
Kingston St., Coleridge to Prospect Ave.:			
Pavement, Walls, Stairs, etc.....	226	40	9,500
Montgomery St., Union to Greenwich:			
Grading, Walls, Stairs, etc.....	687	64' 9"	60,000
Santiago St., 12th to 14th Ave.....	800	80	51,000
Paving, Sewers, Walls, etc.....	200	70	
Twentieth St., Sanchez to Noe St.:			
Pavement, Sewers, Walls, Stairs.....	560	64	36,000
Valley St., Castro to Diamond St.:			
Pavement, Stairs	560	64	10,000
Corbett Ave., Clayton to 24th St.:			
Pavement, Walls, Stairs	3,800	50	100,000
Plans Being Prepared:			
Stanyan St. Widening, Oak to Frederick....	2,100	90	no estimate
Coso Ave., Prospect to Winfield:			
Pavement, Steps, etc.....			30,000
Monterey Blvd., El Verano to San Jacinto:			
Widening Roadways	1,200	80	26,000
Kezar Stadium Road: Pavement.....	2,000	60	60,000
States St., Castro to Levant:			
Elevated Sidewalks			8,000
Union St., Montgomery to Calhoun:			
Grading, Walls, etc.....	240	68' 9"	no estimate
Utah St., 18th to 19th St.:			
Pavement, Sewers, Stairs, Walls.....			20,000
Wolfe, Peralta & Mullen Ave. Intersections:			
Grading, Pavement			2,500

TRAFFIC SIGNS AND MARKERS

Traffic Engineering:

On April 24, 1926, the Mayor appointed the San Francisco Traffic Survey Committee to study traffic "in the hope of evolving constructive suggestions and thus bring about improved street traffic control in San Francisco." This Committee, supported financially by the business interests of the City, engaged a Street Traffic Research Engineer and after a year of study formulated a report on street traffic control. Ordinance No. 7691 (new series) embodying the results of their studies was finally passed September 6, 1927, and intelligent regulation of traffic began to supersede the previous haphazard methods.

One of the many recommendations of the report was, "There should be established a Division of Street Traffic Engineering of the Department of Public Works, . . ." In accordance with their recommendation the Supervisors on October 10, 1927, passed Ordinance No. 7753 (new series) creating a division of street traffic engineering under the jurisdiction of the Board of Public Works and forming a part of the Bureau of Engineering of the Department of Public Works. "The Division . . . shall consist of a competent traffic engineer who shall be known as the city traffic engineer, to be appointed by the said Board of Public Works, pursuant to law. . . . It shall be the duty of the city traffic engineer to conduct studies of street traffic accidents and congestion and of other conditions affecting the safe and convenient use of the streets; to collect facts regarding the effect and operation of regulations controlling street traffic and to plan with and otherwise assist the Police Department and Board of Supervisors in the placing, maintenance and operation of traffic signs, signals and markings, . . ."

G. D. Burr, of this department was appointed City Traffic Engineer. Under his direction studies are made of traffic conditions and remedies are proposed. The traffic division's recommendations have in every case been approved by ordinance. Many changes were made in the original traffic ordinance, the system of arterial streets has been modified, loading zones and no-stop zones have been located and improvements have been made on mechanical traffic aids. The division was called upon to recommend what streets should get preference in the annual street reconstruction program. Due to the dividing of responsibility and authority amongst the Board of Supervisors, Board of Public Works and Police Department, the work of the division is somewhat handicapped, but it is to be hoped that these conditions will be improved as the organization matures.

Traffic Markers:

During the year one contract for installing 60,000 Pedestrian Lane Markers was let for the estimated amount of \$4,352. Bids were received



TRAFFIC SIGNAL
Standard "Stop" and "Go" sign
surmounted by type "A" street sign

by the Board of Public Works on April 4, 1928. Recommendation was made on April 6, 1928, that the Supervisors appropriate \$4,575 to cover the cost of the work and authorize the Board of Public Works to award the contract. On April 23, the Board of Supervisors awarded the contract to E. J. Treacy. To date, due to failure of the Board of Supervisors to appropriate the moneys requested, work has not been begun.

Specifications are being prepared for wiring 500 existing arterial stop signs, which hitherto have not been illuminated. The estimated cost of this work is \$60,000.

Specifications were prepared and bids received April 16, 1928, for 1000 traffic turning buttons, but owing to lack of funds the contract has not been let.

Street Signs:

The erection of street signs has continued systematically in accordance with the plans outlined in former years. Since the standardization of signs the City has placed 3,434 type "A" and 660 type "B" signs. The type "A" sign consists of a 3-inch standard galvanized iron pipe about 9 feet high set in concrete base and surmounted by cast aluminum frames 5 3/8 inches by 22 5/16 inches holding four name plates. The plates are of pure iron on which are enameled white letters 3 inches high on blue background. The front of the plate has five coats of protective porcelain enamel, the back, two coats. Cast iron caps and top piece of the frame are heavily galvanized. The type "B" sign consists of a single name plate on redwood backing and is set on a building or similar improvement, at the smaller streets or alleys. Type "A" signs are set generally one at an intersection, but on the wider and more important streets, two or sometimes four signs are used.

During the year 539 type "A" and 82 type "B" signs were set. The streets in the older settled portions of the City have been generally well marked and the extensions of sign work are now being made largely in the new additions. The latest contracts have covered the placing of signs in the Ocean View District, Golden Gate Valley, Richmond District, the new residential areas west of Twin Peaks and Mt. Davidson and parts of the 100 Vara and Mission Districts.

It is planned during the new fiscal year to place 250 type "A" standards in Sunset, Western Addition, Sunnyside, Mission and Excelsior Districts, to place signs on top of all "Stop" and "Go" traffic signals and to repair and repaint existing standards.

For installation and maintenance of street signs, \$10,000 per year is available.

SPECIAL PROJECTS AND INVESTIGATIONS

Islais Creek Reclamation District:

During the past year proceedings have been steadily progressing to pave the way for the work of reclaiming 280 acres of worthless marsh land into highly valuable industrial property with rail and water facilities for transportation.

On May 27, 1927, the Trustees of the District (City Engineer M. M. O'Shaughnessy, Colbert Coldwell and Stuart F. Smith) referred to the Supervisors the names of three Assessment Commissioners known to be outstanding men in their profession and competent to levy a satisfactory assessment. After much delay in the Streets Committee, the Supervisors finally, by Resolution No. 27,676 (new series) approved August 26, 1927, appointed the three Commissioners suggested by the Trustees, namely, H. W. Crozier, Walter H. Sullivan, and Louis A. Weidenmueller.

The Assessment Commissioners started work immediately and on March 9, 1928, filed an assessment list with the Board of Supervisors who, by Resolution No. 28,705 (new series), approved March 20, 1928, set April 9, 1928, as the day for hearing of verified protests which might be filed.

The work of the Assessment Commission, suggested by the Trustees, had been so well done that there were only four legal protests filed, one of which was to protect the owner in case the roll was changed. In other words, out of 127 owners (including City and State property) involving 794 parcels comprising 8,852,076.60 square feet, and assessed for \$1,620,152.00, protests were filed by only three owners, The Rheinhart Lumber & Planing Mill Company, Wm. Taafe & Company, and Sterling Investment Company (H. A. Whitley), owning 28 parcels, comprising 296,489.70 square feet and assessed for \$41,378.33. That is, 2.36 per cent of the owners, controlling 3.35 per cent of the area and paying 2.55 per cent of the assessment, protested.

Notwithstanding the minority protest, considerable support to the protests developed in the Board of Supervisors and many hearings were held, but due to the united co-operation of the press and the commercial bodies of this City, this assessment roll was confirmed by the Board of Supervisors, by Resolution No. 29,202 (new series), finally passed on June 25th and approved by the Mayor, June 29, 1928.

The next step will be to vote bonds to finance the work and before January, 1929, active work should be under way on all classes of work. In the meantime owners are filling their property by private contract, so that at the present time good progress is being made in reclaiming these marsh areas.

M. H. Levy, Assistant Engineer of this Department, acts as engineer for the district, under supervision of the City Engineer.

San Francisco Bay Bridges:

The efforts of the Board of Supervisors to obtain approval of the War Department of a location for a bridge across San Francisco Bay, as recommended by the special Board of Engineers selected to advise this City in the matter, were detailed in the last annual report of this Department. Having failed to obtain this approval, the Board of Supervisors appointed a new committee, composed of Mayor James Rolph, Jr., City Engineer M. M. O'Shaughnessy, City Attorney J. J. O'Toole, Supervisors Franck Havenner, James B. McSheehy, and Judge Matt I. Sullivan, to draft a bill to be presented to the Congress of the United States for consideration.

This committee consulted with United States Senators Hiram Johnson and Samuel Shortridge, and Congressmen R. J. Welch and Mrs. Florence P. Kahn.

Senator Johnson introduced the bill (Senate Bill No. 1762) in the United States Senate, and it was referred to the Committee on Commerce. The bill was introduced in the House of Representatives as House Bill No. 7467 by Congressman Richard J. Welch and was referred to the Committee on Interstate and Foreign Commerce.

The hearings before the House Committee were held on March 21 and 22, 1928, and the City's case was presented by Richard J. Welch, John J. O'Toole, James B. McSheehy, M. M. O'Shaughnessy, John D. Galloway, Robert Ridgway, Captain George G. Harrison, Florence P. Kahn and John P. Doran. To date, the House Committee has not reported the bill out of committee.

The hearings before the Senate Committee were held on March 29, 30 and 31, 1928. Before this Committee appeared on behalf of the City, John D. Galloway, George G. Harrison, Hiram Johnson, James B. McSheehy, M. M. O'Shaughnessy, John J. O'Toole, Robert Ridgway, James Rolph, Jr., and Judge Matt I. Sullivan.

The Senate Committee reported the bill out favorably on April 17, 1928, after amending it to preclude the City from granting the right to construct a bridge at Location No. 1 to any private individual, and to require the City to finance and construct the bridge itself.

STRUCTURES AND MISCELLANEOUS CONSTRUCTION

Sunset Tunnel:

This fiscal year was marked by the completion of one of the City's major assessment projects, the Sunset Tunnel. This tunnel, 4232 feet long, was completed February 4, 1928, after 605 days of work. Funds of \$1,651,983 were derived from an assessment levied on the 1129 acres directly benefited by the construction of the tunnel. This Department recommended a certificate of conditional acceptance of the work on November 30, 1927.

As of June 30, 1928, the costs are substantially as follows, although some items of extra work still remain to be adjusted:

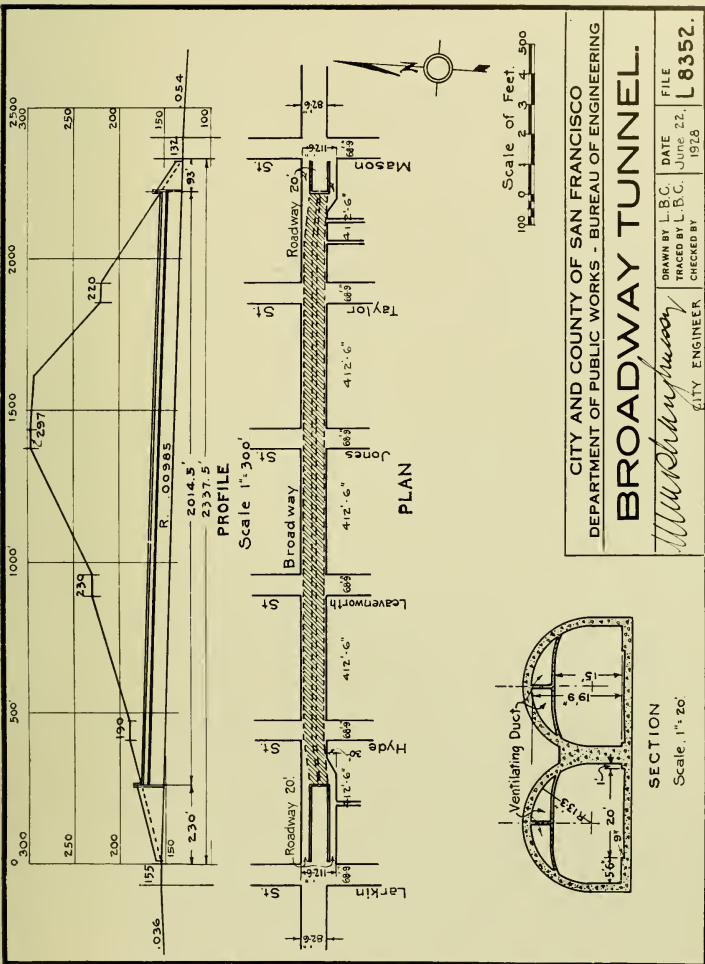
Tunnel Contract	\$1,301,199
Engineering	56,023
Contingencies	9,690
Cost of Collections	10,124
Lands in Fee	96,662
Easements	3,920
Total	\$1,477,618

The tunnel was driven largely through serpentine, although there were small areas of chert, sandstone and basalt, and at the portals both sand and clay.

The work consisted of excavation of two portals in open cut, 261 feet of tunnel section as open cut and 3971 feet of driven tunnel, placing concrete lining in the entire 4232 feet of tunnel, concrete walls at the portals, copings and sidewalks, etc. Quantities involved are noted below:

	Excavation	Concrete	Grout in Overbreak	Sidewalks
	Cu. Yds.	Cu. Yds.	Cu. Yds.	Sq. Ft.
East Portal	5,500	820		5,940
West Portal	4,500	770		8,253
Earth Section	64,960	15,340*	1,830	
Rock Section	59,070	16,440	2,790	
Copings, etc.		290		
Loading Platform		20		
Total	134,030	33,680	4,620	14,193

*Includes 1900 cu. yds. concrete in portion of tunnel excavated as open cut.



Excavation of the driven portion of the tunnel involved 101,800 cubic yards of earth and rock to the prescribed line of tunnel and 10,630 cubic yards of overbreak. Open cut for tunnel section totaled 11,600 cubic yards.

Permanent tunnel lighting was provided by installation of seven 4-inch and two 3-inch fibre ducts in the walls and placing of niches for lamps at 25-foot intervals on alternate sides of the tunnel. An additional 4-inch fibre duct was installed at the request of, and paid for by one of the power companies.

The principal attention of the inspection forces was centered upon the concreting operations. An intensive study was made of the entire operation involved in concrete mixing. These studies and experiments led to adoption of a new method for control of concrete mixing, which stressed the principle of workable concrete with the least amount of water. Using a mix of 93.5 lbs. cement, 191 lbs. dry sand, and 450 lbs. dry rock with 55 lbs. of water (a nominal mix of $1:2\frac{1}{4}:4\frac{1}{2}$) a concrete was secured of 3000 lbs. per square inch compressive strength on a 28-day test, and 4000 lbs. on 90-day test.

The suit to prevent the construction of the tunnel, noted in the last annual report as having been filed by some property owners, was decided adversely to the plaintiffs in a decision of the District Court of Appeals handed down May 21, 1928. Construction of tracks through the tunnel will be noted under "Railways."

Broadway Tunnel:

The financial and commission districts of the City are located in the level area bounded by Market and Kearny Streets, Telegraph Hill and the Bay. The tremendous vehicular traffic between this area and the westerly portions of the City has but three outlets, first, the exits toward the southwest leading into streets of congested traffic; second, the exit via Columbus Avenue along the northerly edge of Russian Hill; and third, Pacific Street, which is the only street with practicable grade to cross the hills that lie to the west of the financial district and extend a mile from Pine Street north to Bay Street. About three years ago Pacific Street was paved with vitrified brick and immediately became an important artery. The street is 49 feet $1\frac{1}{2}$ inches wide, with two 10-foot sidewalks. To allow movement of traffic it has been necessary to prohibit parking on one side of the street during the daytime. The street is inadequate for the traffic it carries, and accidents are frequent, especially at intersections, so a new thoroughfare must be provided.

During the study of methods of handling traffic for the Panama Pacific Exposition of 1914 and 1915, construction of a tunnel under Broadway from Mason Street to Larkin Street was considered. At that time the type preferred was a combined street railway and vehicular, arched structure similar to the Stockton Street tunnel. At present the

street car lines are satisfactorily routed, but automobile traffic has increased more than tenfold, so a tunnel is now proposed for vehicular and pedestrian use only.

Tentative plans and estimates have been made for a twin bore 2015 feet long from portal to portal with open cut approaches of 93 feet at Mason Street and 230 feet at Larkin Street. The parallel tunnels are each to have a height of 19 feet 9 inches, inclusive of ventilating chambers, with arched roof, and a width of 26 feet 6 inches, sufficient for a 5½-foot sidewalk and two lanes of vehicular traffic in each bore. The grade rate is slightly less than 1 per cent ascending westerly. Total estimated cost is \$1,520,000. Various methods of financing the work have been suggested, the one at present in most favor being to provide about one-half by bond issue by the City and one-half by assessment on the districts to be most directly benefited.

San Francisco Municipal Airport:

The year has shown marked success in the operation of Mills Field, San Francisco Municipal Airport. Since the inauguration of flying from this field on May 5, 1927, 10,646 flights and landings have been made and 16,667 passengers have been carried.



MILLS FIELD, SAN FRANCISCO MUNICIPAL AIRPORT
Hangar No. 2

Although the field has been planned for commercial flying it has been used often as the starting point for very large, heavily laden planes in distance and endurance flights. On December 3, 1927, Captain Smith and Lieutenant Pond, in an attempt to establish an endurance record, hopped in a ship of gross weight of 15,562 pounds, carrying 1418 gallons of gasoline. The plane took off in a distance of 3200 feet, which was covered in 54 seconds.

On September 21, 1927, in the Pacific Coast 900-mile Air Derby from San Francisco to Spokane, five starters in one event took off in 1 minute 34 seconds.

The first Western Aircraft Show was held at Mills Field April 11-15, 1928. This featured a manufacturers' display in addition to various races and landing contests.

Mills Field is terminus for passenger and freight lines operating on regular schedules to the principal cities as far north as Seattle and south to Ensenada, Baja California, and with connections to all parts of the United States.

Col. Lindbergh, the American air idol, who has chosen this airport as his western headquarters, is most enthusiastic in his praise of the equipment and management of the field, as the following quotation shows:

"Mills Field is one of the best conducted and finest equipped airports I have ever seen, and you know I have seen most of them. I want to congratulate San Francisco on the marvelous development of this field. I am pleased to make Mills Field my western headquarters. I like the way you do things here and I like the way you have brought this field along."

As noted in the report for the previous fiscal year, meteorological investigations were carried on not only at Mills Field but at other locations which have been considered as possible sites for a permanent airport. The results of these studies were embodied in a report entitled "Meteorological Survey of Proposed Sites for the San Francisco Municipal Airport," by Ernest E. Eklund, Meteorologist, U. S. Weather Bureau, July 10, 1928, who was stationed at this field for a year.

This report recites the history of the airport project, the physical requisites of an airport, the availability of the sites, meteorological characteristics affecting aviation, organization and equipment of survey, results of investigation, and conclusions and recommendations. The survey is the first of its kind that has ever been attempted. The initial arrangements and general scheme were worked out by the City Engineer's office in co-operation with the Weather Bureau, and the City purchased most of the instruments, and built and equipped the stations.

Observations began in July, 1927, and were continued through June, 1928. The conclusions were summarized as follows:

Fog, Visibility and Ceiling—

Fog was observed at Mills Field fewer times than at the other stations considered. Visibility was better there and the ceilings were more advantageous.

Wind Direction—

Constancy of wind direction was found to be more marked at Mills Field and a runway headed between W and WNW could be used a large part of the time.

Wind Velocity, turbulence and gustiness—

Although one of the other sites showed slightly less wind velocity and fewer high winds, its gustiness compared unfavorably with Mills Field and its turbulence was about equal.

Precipitation—

There was no important difference in precipitation in the various sites.

Summary—

“—it is obvious that Site No. 6 (Mills Field) has an advantage over all proposed sites in freedom from fog, visibility, ceiling, and constancy of wind direction. . . . The majority of take-offs may be made over favorable territory. . . . Site No. 6, the location of the temporary airport, is therefore recommended as a result of the meteorological survey as the most suitable one for the permanent location of the San Francisco Municipal Airport.”

In view of the marked success of the field it is now planned to submit to the voters a bond issue of \$2,000,000 for permanent development. The improvement of the field under this proposed plan includes reclamation of the submerged area immediately adjoining the field, construction of runways 6100, 5800, 5500 and 4000 feet long, facilities for seaplanes, many additional hangars, administration building, machine and other shops and the various other items to fulfill the requirements of the U. S. Department of Commerce for its highest rating A1A.

During the year the principal improvement at the Field has been the construction of Hangar No. 2, which is 85 feet by 360 feet by 35 feet high, with floor area 30,600 square feet, sufficient to house 30 average size planes. This building has portable steel frame resting on concrete caps on 60-foot Douglas Fir piles, and is sheathed with galvanized, corrugated steel. Three separate bays are provided, each 120 feet by 85 feet, and containing office and toilet. Concrete floor is 4 inches thick except at joints, where it is 6 inches. The doors, which are now being installed, are of rolling shutter type with 18 feet vertical clearance. The curtains 17 feet wide are motor operated and slide in grooves in steel pedestals. They can be raised or lowered at a speed of 7½ feet per second. Total weight of doors is 60,000 pounds, inclusive of central pedestals.

During the year a concrete apron 100 feet wide was constructed over the entire front of Hangars Nos. 1 and 2, a length of 534 feet. On this apron a wash rack area 50 feet by 100 feet is provided. Drainage pipes were installed under the concrete as part of the future general scheme of drainage.

A comfort station was erected near the highway and back of Hangar No. 1. This is a frame building with concrete floor covering 15 feet by 25 feet.

Additional automobile parking space of 40,000 square feet was provided by macadamizing the area between the hangars and the drainage ditch alongside the highway.

During the year the State completed the macadamizing and oiling of the Bay Shore Highway, the principal road to the field, and a new road was extended from the Peninsular Highway at San Bruno to meet this highway.

Auxiliary Water Supply (High Pressure) System Extensions:

One important extension to the high pressure mains has been made during the year. This is a 12-inch main connecting to the grid system on Harrison Street at Twenty-fifth Street, leading along Twenty-fifth Street, Potrero Avenue, Army Street and Evans Avenue to a connection with the existing Butchertown system on Rankin Street. An additional 12-inch by-pass line was laid from the new line on Army Street at Potrero Avenue via Potrero Avenue, San Bruno Avenue, Jerrold Avenue and Napoleon Street to a connection back to the new line at Evans Avenue.

This new extension not only gives adequate protection to the industrial district traversed but also improves conditions in the system already in operation in Butchertown. The Butchertown system originally was supplied through a connection with the Spring Valley Water Company's system. This connection, which can now be dispensed with, was depended upon to furnish sufficient water so that pumper engines could take care of fires until the arrival of one or two fireboats to pump salt water from the Bay into the pipes. The new connection gives an ordinary static pressure through the Butchertown district ranging from 150 to 160 pounds per square inch.

Under this contract, two miles of 12-inch pipe were laid and sixteen standard 3-way hydrants were set. Tees and gates were provided for additional hydrants to be set at a later date.

Building of the War Memorial and Opera House on Van Ness Avenue opposite the City Hall, necessitates the closing of Fulton Street from Van Ness Avenue to Franklin Street and the removal therefrom of

an 18-inch high pressure pipe. Plans are now being prepared for removing this pipe and laying a new line via Franklin and Grove Streets to a connection at Van Ness Avenue. It will be necessary to purchase new pipe for this work. Funds will be obtained from the War Memorial Bond Issue.

Plans and specifications are complete for an extension of the high pressure system along Pacific Avenue from Divisadero Street to Lyon Street, and thence to Clay Street as the first link of a loop to lead through the Richmond District and back across Golden Gate Park Panhandle to a connection with the existing system near Haight and Clayton Streets. This first link involves the laying of 2,350 feet of 12-inch pipe at an estimated cost of \$2,350, while the completed loop of about four miles as now projected, is estimated to cost \$115,000 additional.

Municipal Water Works Extensions:

Two extensions of the Municipal Water Works system were made during the year, one of 1,350 feet along San Bruno Avenue from Wilde Avenue to the northerly line of Ordway Street and one of 580 feet on Alpha Street from the southerly line of Raymond Avenue to the northerly line of Teddy Avenue.

Inasmuch as the Municipal Water Works will be incorporated into the Spring Valley Water Company's system when the City takes over operation of the latter within the next few months, the following brief description of the plant is given.

This system, formerly called the County Line Water Company, was acquired by the City from the Potter Realty Corporation under authority of Resolution No. 4735 (new series) of the Board of Supervisors, approved November 10, 1909, for a consideration of \$25,000.

At that time its consumers were almost entirely residents of the Reis Tract on the northerly slope of Visitacion Valley. Although the Crystal Springs Aqueduct of the Spring Valley Water Company passes through this tract, the pressure is insufficient to reach to the higher hills, so the real estate firm handling their subdivision built the water works. Under City management, the number of consumers has steadily increased.

In a lot 34 feet by 90 feet, on Leland Avenue near San Bruno Avenue at elevation 26 feet, the City has two wells, one of which is at present out of use on account of being partially filled with sand. The wells are equipped with deep well pumps, one of 135 and the other 190 gallons per minute capacity. Separate discharge tanks receive the water pumped from the wells. From each tank, water can be pumped by separate force pumps through 4500 feet of riveted steel main 8 inches in diameter to a reservoir of 500,000 gallons capacity, on Wilde Avenue and

Oneota Street at elevation 400 feet. The force pumps, which are motor operated, have capacity of 160 and 170 gallons per minute. A small district too high to be tributary to Wilde Avenue Reservoir, is supplied from a 30,000 gallon tank at 480 feet elevation in La Grande Avenue between Excelsior Avenue and Avalon Avenue, into which water is pumped from a main on Oxford Street by a motor driven pump of capacity of 100 gallons per minute.

The sizes and lengths of pipes of the distribution system are as follows:

12 inches diameter.....	0.208 miles
8 inches diameter.....	2.420 miles
6 inches diameter.....	2.920 miles
4 inches diameter.....	0.284 miles
3 inches diameter.....	0.284 miles
2 inches diameter.....	9.250 miles
1 ½ inches diameter.....	1.450 miles
Total.....	16.816 miles

Average daily consumption for the fiscal year was 165,800 gallons, of which 135,000 gallons was pumped from the well and the remainder, 30,800 gallons, was taken from the Spring Valley system and pumped into the reservoirs. In the month of June, 1928, the well became sanded, due to imperfect casing. It was cleaned and relined and is now furnishing 160,000 gallons daily.

The system now supplies 899 services, of which 892 are metered, and 62 fire hydrants. No payment is credited for fire hydrants, although the rate in other parts of town is \$3.00 per hydrant per month.

The growth of the system is shown in the following comparative statistics for 1913-1914 and 1927-1928:

	1913-14	1927-28
Water pumped from well—gals.....	29,854,000	49,377,250
Water bought from S. V. W. Co.—gals.....		11,252,250
Water pumped to reservoirs—gals.....	29,854,000	60,629,500
Total expenditures per 1000 gals.....\$	0.1675	\$ 0.517
Total operating expense per 1000 gals.....	0.1465	0.310
Total income per 1000 gals.....	0.1520	0.308
Total value of plant	\$ 30,171.38	\$122,517.00

Extensions made for any particular piece of property are paid for by the property owner affected. Major reconstruction generally requires appropriation of City money. The system is run at a slight loss.

Maintenance of Bridges:

The City operates a number of bridges, the maintenance of which is under the jurisdiction of the Board of Public Works. Three of these bridges have required considerable attention from this department during the year.

On Third Street at Channel, a navigable waterway 135 feet wide, a double leaf Page bascule bridge of 82 feet 6 inches span carries a double track street railway with cars weighing 20 tons and the very heavy vehicular traffic to and from the railroad freight yards. The top of the south abutment has been slowly moving inward toward the channel for many years, during which from time to time, small cuts aggregating 2 feet were made from the south leaf to permit operation of the bridge. The creeping of the abutment has been stopped by tying it with twelve steel rods to two concrete anchors set on nests of piles well back from the abutment. The cost of this work was approximately \$14,000.

Plans are completed for reflooring this bridge, using steel plates in the line of wheel treads, at an estimated cost of \$5,000.

Twice during the year the fender piling at abutments has been damaged by improper handling of ships. In each case the City has repaired the piling, billing the navigation companies for the cost.

Due to recommendation by the commercial bodies of San Francisco the construction of a new bridge at this site capable of carrying the Harbor Belt Line Railway with heavy locomotives and cars is being considered, the cost to be borne by the State Harbor Commission and the City and County of San Francisco.

On Third Street at Islais Creek Channel the main bearings were repaired on the one-leaf heel trunnion type Strauss bascule bridge.

At Beale Street and Harrison Street, the rotting of wooden stringers on the fixed bridge, necessitated the placing of wing walls and a fill. Work on this bridge is considered largely as temporary pending the proposed regrading of Rincon Hill, which will eliminate the necessity for the structure.



ISLAIS CREEK STORM SEWER
Storm drain under Bay Shore Boulevard



SEWERS

Current Construction:

The greatest development of concrete sewers during the year was in the Sunset District. The work on Section B Westerly Sunset District Main, begun in the previous year, was completed. This section extends from Rivera Street and Thirty-first Avenue in a general northwesterly direction to Forty-second Avenue and Lawton Street. The contract involved the construction of 9596 lineal feet of concrete sewer ranging from 2 feet by 3 feet flat top to 4 feet by 6 feet egg shaped. The total area drained by this section and by Sections A and C completed in the previous year, is 530 acres.

The second section of the Central Sunset District Main along Twenty-ninth and Thirtieth Avenues, connecting at Kirkham Street and Thirtieth Avenue with the section noted in last year's report as completed, is now under construction. This sewer varies in size from 2 feet by 3 feet to 3 feet by 4 feet 6 inches, is 2,977 feet long, and together with the first section drains 285 acres.

A 2-foot by 3-foot concrete sewer is under construction on Wawona Street, from Twenty-fifth Avenue to Thirty-fourth Avenue, a distance of 2,879 feet.

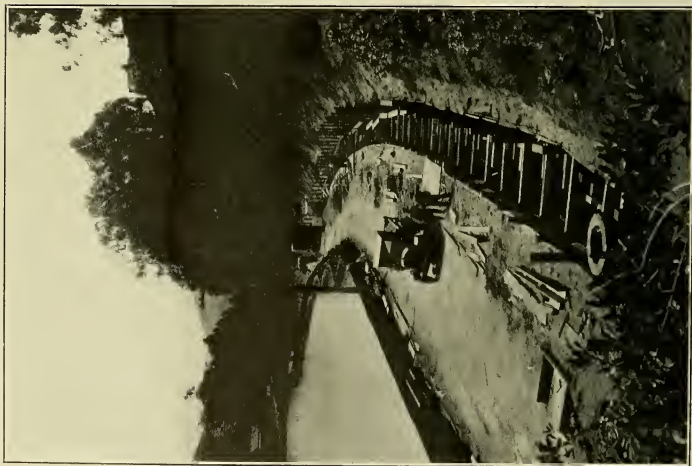
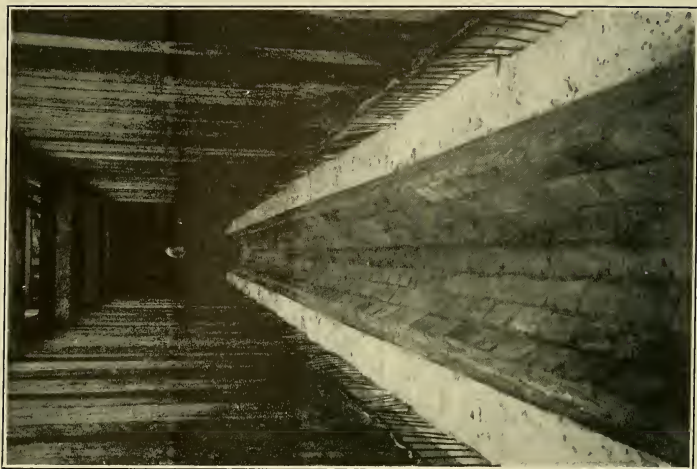
The construction of 2170 feet of 2-foot by 3-foot concrete sewer on Quintara Street from Fortieth Avenue to Forty-sixth Avenue at an estimated cost of \$20,000, which is planned for the new fiscal year, will practically complete the main concrete sewer system of the Sunset District.

A 3 foot 6 inch by 5 foot 3 inch egg shaped concrete sewer is now under construction along the line of the Laguna Honda Boulevard. Its cost will approximate \$32,000. This will replace an old 4-foot circular brick sewer which interfered with the construction of the new boulevard.

For many years the main sewers draining the Fillmore Street vicinity in the Western Addition have been known to be inadequate for storm flow and this office has attempted from year to year to have money appropriated to correct this condition. Contract has been let and work begun on 1177 feet of 6 foot 9 inch circular sewer on Tenth Street from Harrison Street to Division Street, the first unit of this main, at an estimated cost of \$53,000, and plans are under way for a second unit 3,082 feet long from Harrison Street to Van Ness Avenue, at an estimated cost of \$125,000. These units form the lower part of the outlet system.

The construction of 1010 feet of 2 foot by 3 foot concrete sewer, now under way at an estimated cost of \$7500 on an easement near Guttenberg Street from Morse Street to Hanover Street, will permit the filling of a deep gulch preliminary to paving of Brunswick and Concord Streets.

Sewers are being laid in Golden Gate Heights by day labor forces of the Side Sewer Department under the direction of an inspector from this



LAGUNA HONDA BOULEVARD SEWER



WESTERLY SUNSET DISTRICT SEWER
Rivera Street west from Thirty-first Avenue



FILLMORE STREET SEWER
6' 9" circular sewer on Tenth Street



WAWONA STREET SEWER
2' x 3' flat top

department. To date 16,149 feet of 18-inch, 12-inch, and 8 inch sewer and 10-inch culvert pipe with necessary manholes and catchbasins have been laid at a total expense of approximately \$32,000 exclusive of engineering. The plans provide for approximately 42,000 feet of sewer in the tract.

The sewage pumping station in Pinelake Park has been completed and is in operation, lifting sewage from the low-lying Pinelake Park District into the Thirty-fourth Avenue main.

Sewers Planned:

Development of the industrial area in the Bay View District will be facilitated by the extension of the Ingalls Avenue and Bancroft Street sewers, plans for which are now complete. The projected work, of which the estimated cost is \$19,200, involves the construction of 1110 feet of 4 feet x 6 feet and 2 feet 6 inch x 3 feet 9 inch concrete sewer.

Plans have been prepared for the construction at an estimated cost of \$112,000 of 4,580 feet of 2 feet 6 inch x 3 feet 9 inch, 3 feet x 4 feet 6 inch and 3 feet 6 inch x 5 feet 3 inch concrete sewers on Twenty-third, Army and Indiana Streets to serve the rapidly growing industrial area of the southerly Potrero District. These main sewers are urgently needed but at present no funds are available for their construction.

The development of the Islais Creek Reclamation District will necessitate the construction of 3,555 feet of outfall sewer to handle the storm drainage from the entire Islais Creek Valley which now discharges into the open creek channel a short distance below the Mission Viaduct. Present plans contemplate the construction primarily of an 8 feet by 14 feet wood box through the Reclamation District from Oakdale Avenue to Islais Creek Channel at an estimated cost of \$160,000, which will be borne by the District.

Approval has been given to plans submitted to this office for sewer construction in El Plazuela, Monterey Heights No. 6, Castle Manor, Westwood Highlands No. 3, Balboa Terrace Addition, Miraloma Park, Balhi Court and Salvation Army College tracts.

Necessity for Sewer Bond Issue:

Provision for taking care of the reconstruction of antiquated main sewers, some of which survived the earthquake of 1906, together with the construction of extensions to main sewers to provide adequate drainage, has been neglected, due probably to the fact that sewers are out of the sight and therefore out of the mind of the general public until the periodic floods that arise in certain sections of the City where main sewers are of inadequate size or in such condition due to age that they are ready to collapse.

Districts which are not adequately sewered and in which considerable damage is done as the result of flooding of basements, are the old Mission Creek Valley extending from Fillmore Street down McAllister Street past the Civic Center to Tenth and Market Streets; Fourteenth, Market and Church Streets; and the vicinity of Geary Street and Twenty-third Avenue. The existing sewers, ranging in size from old 3 feet by 5 feet brick down to 12 inch pipe are inadequate and insecure and must be replaced by sewers ranging in size from 2 feet by 3 feet egg-shaped to 6 feet 9 inch circular.

Examples of old sewers which are about to crumble and cannot carry the requisite flow, exist on Sixth Street from Harrison Street to Bryant Street and from Townsend Street to Channel Street; on Brannan Street from Third Street to Seventh Street; and on Division Street from Tenth Street to Fifteenth Street. These sewers, varying in size from 2 feet by 3 feet to 6 feet by 7 feet 6 inches, are built of brick and are not set on piles, although they are in ground that is continually settling. They must be replaced by modern reinforced concrete structures varying from 2 feet by 3 feet up to two compartments 9 feet by 10 feet, all on adequate pile foundations.

Drainage of the valley of Islais Creek, including Sunnyside and Glen Park, from the County Line near Ocean View to the Mission Viaduct, an area of about 3 square miles, will flow through the Alemany Boulevard and Industrial Street sewers, and through the College Hill sanitary sewer which will be largely tunnel. These mains will consist of various cross sections, from 4 feet by 6 feet up to two compartment 8 feet by 10 feet, of reinforced concrete. At present there are continual complaints of nuisances along Islais Creek from Mission Street to San Bruno Avenue, where sewage flows in the open channel of the Creek.

Industrial areas rapidly developing, for which there are no adequate drainage facilities, are, as above noted, the southerly Potrero and the Bay View Districts and also the area southerly from the Islais Creek Reclamation District.

Such sewers as are above enumerated must be constructed out of bond moneys, because of their large cost and the fact that the benefits to be derived from their construction will extend over many years.

Side Sewers:

During the year, 1513 applications for side sewer construction were received and collections of \$108,839.01 were made. The marked decrease over the previous year is explained by the fact that on all new main sewer construction, all necessary side sewers are now laid by contractors without any application made or fee paid to this office. The amount charged for side sewer work is based upon the district and character of soil and pavement in which the work is done. There are five main districts and the fee ranges from \$2.75 to \$4.75 per lineal foot of sewer.

These applications were distributed over the months as follows:

	Number Applications	Amount Collected
1927		
July	160	\$12,875.58
August	171	13,297.80
September	141	10,710.25
October	151	10,248.75
November	128	8,568.60
December	110	8,494.75
1928		
January	99	6,570.63
February	110	7,059.00
March	111	7,117.75
April	103	7,985.75
May	124	9,168.00
June	105	6,742.25
Totals.....	1,513	\$108,839.01

STREET WORK PERFORMED UNDER CONTRACTS

JULY 1, 1927, TO JUNE 30, 1928

	Quantity	Cost
Asphaltic Concrete Pavement:		
8" concrete base, 1½" wearing surface, 1½" binder	5,302 sq. yds.	\$ 14,315
6" concrete base, 1½" wearing surface, paint coat	400,915 sq. yds.	1,082,229
6" concrete base, 1" wearing surface, 1½" binder	15,683 sq. yds.	38,581
3½" black base, 1½" wearing surface	16,359 sq. yds.	41,864
10" rock base, 1½" wearing surface	5,974 sq. yds.	10,484
Asphaltic Concrete Pavement, with concrete strip:		
6" concrete base, 1½" wearing surface, paint coat	5,512 sq. yds.	14,783
6" concrete pavement	1,615 sq. yds.	4,902
Asphaltic Concrete Pavement, with brick strip:		
6" concrete base, 1½" wearing surface, paint coat	36 sq. yds.	114
Vertical fibre brick	19 sq. yds.	105
Asphaltic Concrete Pavement, with basalt block strip:		
6" concrete base, 1½" wearing surface, paint coat	144 sq. yds.	637
Basalt block pavement	78 sq. yds.	490
Asphaltic Surface—conform	2,539 sq. yds.	1,652
Asphaltic Binder	467 tons	3,666
Basalt Block Pavement—relaid	133 sq. yds.	120
Concrete Pavement—6"	74,059 sq. yds.	206,119
Macadam Pavement	18,728 sq. yds.	7,278
Gutters—concrete	2,415 sq. yds.	5,137
Curb:		
Granite, new	67 lin. ft.	117
Granite, reset	1,453 lin. ft.	442
Concrete, new	237,384 lin. ft.	233,763
Concrete, reset	3,114 lin. ft.	808
Wheelguards, concrete	235 lin. ft.	138
Headers, redwood	3,539 lin. ft.	622
Sidewalks, Artificial Stone	33,006 sq. yds.	48,262
Grading:		
Cut	565,457 cu. yds.	485,490
Fill	35,330 cu. yds.	18,353
Stairways	7 only	955
Retaining Walls:		
Concrete	11,395 cu. yds.	285,959
Reinforcing steel	396 tons	35,535
Rubble Walls	1,281 cu. yds.	8,966
Balustrade	41 lin. ft.	308
Pipe Railing	261 lin. ft.	565
Guard Rails and Fences	907 lin. ft.	784

Street Work Performed Under Contracts—Continued

	Quantity	Cost
Sewers, Reinforced concrete:		
4' 0" x 6' 0" egg-shaped	3,089 lin. ft.	58,379
3' 6" x 5' 3" egg-shaped	3,468 lin. ft.	55,149
3' 0" x 4' 6" egg-shaped	549 lin. ft.	5,923
2' 0" x 3' 0" egg-shaped	2,974 lin. ft.	36,540
Taper and junction structures.....	4 only	1,150
Concrete piers	31 cu. yds.	775
Reinforcing steel in piers	7,400 lbs.	370
Sewers, ironstone pipe:		
21" diameter	1,044 lin. ft.	3,828
18" diameter	4,464 lin. ft.	18,578
18" diameter in concrete.....	60 lin. ft.	240
15" diameter	7 866 lin. ft.	26,140
12" diameter	21,009 lin. ft.	71,907
8" diameter	38,997 lin. ft.	88,356
6" diameter side sewers.....	97,717 lin. ft.	94,138
Sewers, cast iron pipe:		
8" diameter	539 lin. ft.	1,994
12" diameter	51 lin. ft.	306
Y-Branches:		
On 21" sewers.....	32 only	63
On 18" sewers.....	144 only	341
On 15" sewers.....	293 only	565
On 12" sewers.....	899 only	1,502
On 8" sewers.....	1,803 only	2,476
Manholes:		
On concrete sewer	46 only	4,780
On ironstone pipe sewer.....	376 only	41,684
Lampholes	4 only	200
Catch Basins:		
New	500 only	55,716
Reset	35 only	2,196
Stormwater Inlets	11 only	631
Concrete Sumps	56 only	2,800
Culverts, 10" Ironstone Pipe.....	16,745 lin. ft.	29,776
Reflectors, Warning Lights	27 only	2,320
TOTAL COSTS		\$3,162,404
Summary—Cost of Street Work:		
Public Contracts		\$ 758,529
Private Contracts		1,944,500
City Pay		459,375
TOTAL		\$3,162,404

STREET IMPROVEMENT ASSESSMENTS, ETC.

Assessments and Bonds for Street Work:

Assessments issued for cost of street work performed.....	122
Cost of street improvements covered by assessments.....	\$971,021.31
Bonds prepared (in triplicate)	456
Amount of assessments guaranteed by bonds.....	\$212,959.93
Average amount guaranteed by each bond.....	467.01

Street Work Proceedings:

Resolutions of Intention passed	47
Street improvements recommended under Res. of Intention....	155
Notices of street improvement posted	2,482
Notice of Resolution of Intention mailed.....	3,979
Ordinances ordering performance of St. Impvts. passed.....	154
Proposals of street improvements published.....	155
Public contracts for street improvements awarded.....	152
Private contracts filed	286

Public Proceedings for Sidewalks:

Contracts formulated	68
Surveys made	54
Examination sheets made	45

Notices, Permits and Investigations:

Notices to construct and repair sidewalks.....	3,748
Notices to construct bulkheads	563
Notices to remove obstructions	1,565
Notices to obtain curb lowering permits	474
Notices to construct guard rails	22
Notices to obtain oil tank permits	235
Notices to reconstruct side sewers	84
Notices to obtain street space permits	980
Street space permits reported on	3,694
Oil tank permits reported on	474
House moving permits reported on	139
Miscellaneous calls and investigations	3,417

Permits and Fees for Corporation Trenches and Main Line Extensions:

	Service Connections	Mains Lineal Ft.	Fees
Pacific Gas and Electric Co.....	4,092	91,073	\$6,621.00
Spring Valley Water Company.....	3,387	25,149	5,283.75
Pacific Telephone & Telegraph Co.....	719	20,627	1,265.00
Great Western Power Co.....	120	23,830	372.00
Western Union Telegraph Co.....	6		9.00
*Miscellaneous under Special Deposits....			7,221.50
Total	8,324	160,679	\$20,772.25

*Permits granted for which special deposits were made, to move steam shovels and tractors, to repair or install oil tanks, service pipes, fire alarm wires, cables and conduits, to lower curbs, etc.

SURVEYS

Surveys Performed:

For public contracts	92
For private contracts	530
Resurveys for contracts	227
For Municipal Departments	430
Total for public improvements, etc.....	1,279

Lot Surveys:

For private owners	19
For Municipal Departments	8
Total Lot Surveys	27

Total Surveys	1,306
---------------------	-------

Surveys include approximately 2508 blocks and crossings, a total of 755,000 feet or 143 miles, in addition to 40 miles of Highway, Municipal Railway, and monument line surveys, and the replacing and referencing of 274 monuments. Surveys were also made in connection with Municipal Airport, Golden Gate Heights Sewers, Esplanade, Bernal Cut, Islais Creek Reclamation District, Great Highway, and tests on subsidence areas. The Highway surveys included Alemany Boulevard, Bay Shore Boulevard, Junipero Serra Boulevard Widening, Portola Drive Widening, and Nineteenth Avenue Extension. The Judah Street Railroad line was surveyed for Municipal Railway from Duboce Avenue and Market Street to Judah Street and Forty-Eighth Avenue.

Precise Levels and Bench Marks:

District	Number of Bench Marks	Precise Levels
South San Francisco	176	4.50 miles
Sunset District	625	16.70 "
Western Addition District	561	14.40 "
Homestead District	54	1.60 "
100 Vara District	98	2.50 "
Laguna Honda District	135	2.00 "
50 Vara District	1570	43.00 "
Total	3219	84.70 "

Maps Approved and Recorded:

Parker Avenue Widening (south of California Street fronting on Laurel Hill Cemetery).

Balboa Terrace Addition (Blocks 3260 to 3269).

Point Lobos Avenue Widening (Forty-third to Forty-fourth Avenue).

Twenty-third Street Widening (Third Street to its easterly termination).

Western Addition Block No. 476.

Western Addition Block No. 478.

Miraloma Park Subdivision No. 4.

Gloria Court Opening.

Castro Street Widening (Twenty-ninth to Thirtieth Street).

Miraloma Park (Parcels to be deeded to City and County of San Francisco for opening of streets and alleys).

Geneva Terraces Subdivision No. 1.

Ridge Lane Widening (Josiah Avenue to Howth Street).

Westwood Highlands (Blocks 3004-B, 3005-B, 3005-C, 3005-D, and parts of Blocks 2973, 3088, and 3054).

Monterey Heights (Blocks 3040, 3041, 3043, and parts of Blocks 3039, 3042, 3047 and 3077).

Castle Manor.

Laguna Honda Boulevard Opening (Noriega Street to Laguna Honda Home).

Laguna Honda Park Addition.

Golden Gate Heights Resubdivision of Lot 8, Block 1860-A; Lot 4, Block 1861-B; all Block 1928-A; Lot 1 of Block 1929-A; and Lots 1 and 5 of Block 2034-A.

Miraloma Park Subdivision No. 5.

Moscow Street Widening at France Avenue.

Elk Street Extension from Chenery to Bosworth.

Bay Street Opening between Fillmore and Webster.

Mangels Avenue, Closing of Portion of Northeasterly Intersection at Hazelwood Avenue.

San Jose Avenue Widening from Ottawa to Sickles Avenue.

Cunningham Place.

Niagara Avenue Extension to Edgar Avenue.

Rae Avenue Opening between Whipple and Naglee Avenue.

Miraloma Park Subdivision No. 6.

Noriega Street Widening from Thirty-first to Forty-eighth Avenue.

Of the above-mentioned filed maps, 18 were made in this office; the remainder, which are subdivision maps, were checked as to location of streets, ties to adjacent tracts, monuments and legal requirements.

Working maps were made, legal descriptions prepared, and the dimensions computed of each parcel of property to be acquired on Bay Shore Boulevard, Alemany Boulevard, Junipero Serra Boulevard Widening, Nineteenth Avenue Extension, Van Ness Avenue Extension, and Portola Drive from Twenty-fourth Street to Fowler Avenue.

594 property descriptions were written and checked.

70 suits to quiet title, containing from 1 to 75 parcels of property each, were checked to see that there was no encroachment on City Property.

Fees Received for Surveys and Inspection:

Month	Surveys	Inspection
1927:		
July	\$ 2,319.85	\$ 4,091.60
August	2,861.10	6,643.10
September	2,069.10	5,167.75
October	2,115.04	3,363.20
November	1,946.55	9,754.10
December	2,904.35	9,850.60
1928:		
January	2,926.15	2,217.90
February	3,156.15	2,711.05
March	9,301.37	3,817.80
April	4,781.09	3,612.10
May	2,836.65	5,172.35
June	3,077.47	4,802.85
	<hr/>	<hr/>
	\$40,294.87	\$61,204.40

RAILWAYS

Unified Transportation System:

The impending expiration of the franchises of the California Street Cable Railroad system and of franchises covering some of the most important lines of the Market Street Railway Company has made the question of the acquisition of the properties of these companies one of great importance. After considerable discussion and correspondence between this office and the Board of Supervisors, a definite step toward the solution of the problem was taken by the inclusion in the budget for the coming fiscal year of an item of \$30,000 to cover the cost of a report on the railway situation. On June 22, 1928, the City Engineer addressed the following communication to the Board of Supervisors:

"To the Honorable

The Board of Supervisors of the
City and County of San Francisco.

Gentlemen:

As your Board is aware, the several franchises under which the California Street Cable Railroad Company operates expire on February 17, 1929, and that likewise a number of important franchises under which the Market Street Railway Company operates expire in this same year on several varying dates, extending from February to December.

The expiration of these various franchises will present a very complex problem to your Board in determining the best way in which the general policy laid down in the charter—of the gradual acquisition and ultimate ownership of our public utilities—may best be furthered in connection with street railways. For a number of years past, in the annual report of this office, I have pointed out the necessity of a comprehensive study and report on the entire street railway situation, and urged that funds be provided to prepare such a report. Your Board in this year's budget has made certain provision for such a report.

Following are a number of the problems which may be considered and studied as a part of such report:

- (1) The ideal layout of a unified transportation system for San Francisco as to car routing, car storage facilities, and power sub-stations, as of today and with due regard to the future, having in mind the possible future development of the City as to new developments in the way of boulevards, tunnels, subways, bridges, and the possible extension of our boundaries.
- (2) A study of the relation of the existing trackage and layout with reference to the ideal system.
- (3) The necessary or advisable changes in the way of extensions, abandonments, or re-routing, in order to most fully utilize the existing street railway trackage and facilities toward the consummation of the ideal.
- (4) Valuation of the California Street Railway system and the Market Street Railway system, on the basis—(a) of its physical property; (b) with reference to usefulness as parts of the practical unified system; (c) as affected by franchise expirations. Such valuation to be so set up as to make possible the

consideration of the several portions of the system as may be desirable in considering the portions involved in the unified system and by franchise expirations.

(5) A discussion as to whether the system should be acquired in its entirety or piecemeal as the franchises expire.

(6) An estimate of the operating results under municipal operation of the unified system—(a) from the point of view of service to the public; (b) from the financial viewpoint.

(7) The consideration of the same as affected by piecemeal acquisition as franchises expire.

(8) The possible methods of financing the purchase of the properties .

(9) The method of providing for future extensions.

(10) Possible alternative methods of handling the transportation problem other than outright purchase of the properties.

(11) Legislation necessary or advisable to facilitate the solution of the railway problem.

From the above it will be realized that the preparation of such a report is no small task, and, including the valuation, will require approximately six months' time, and as I previously estimated, in a communication to the Public Utilities Committee under date of February 18, 1928, will require approximately \$40,000.

In order that this work may be undertaken at the earliest possible moment and pressed to a conclusion, I am submitting herewith a form of ordinance authorizing the City Engineer to undertake and prepare this report, and appropriating the necessary funds therefor. This ordinance has been prepared in proper form by the City Attorney and it is recommended that it be passed by your Board at the earliest possible date.

(Signed) M. M. O'SHAUGHNESSY,
City Engineer."

The draft of the ordinance mentioned in the above letter is as follows:

Authorizing and directing the Board of Public Works to investigate and report upon the immediate and future street railway transportation requirements of San Francisco, and to recommend what portions, if any, of the existing privately owned street railway systems should be acquired by the City, and authorizing the City Engineer and the City Attorney to make a valuation of the California Street Cable Railroad Company's system and the Market Street Railway Company's system and authorizing the City Engineer and the City Attorney to enter into preliminary negotiations with the California Street Railroad Company and the Market Street Railway Company looking toward the possibility of the purchase of these systems in whole or in part and making an appropriation therefor.

Be it ordained by the People of the City and County of San Francisco as follows:

WHEREAS, under its charter the City of San Francisco is committed to the policy of gradually acquiring and ultimately owning all of its public utilities, and

WHEREAS, the City and County of San Francisco now operates a municipally owned street railway system furnishing transportation to many parts of the City, and

WHEREAS, the franchises of the California Street Cable Railroad Company and a number of franchises of the Market Street Railway Company will expire during the year 1929, and

WHEREAS, it is essential that this Board of Supervisors adopt a plan under which the people of San Francisco can be assured of proper transportation facilities after the expiration of the existing franchises,

THEREFORE, in order that this Board may have before it as a basis for determining the best policy to be pursued in the solution of the City's transportation problem,—

Section 1: The Board of Public Works is hereby authorized, empowered and directed to instruct the City Engineer to investigate and report to the Board of Supervisors upon the immediate and future street railway transportation requirements of San Francisco; to what extent and in what manner the existing street railway trackage and facilities in San Francisco could best be utilized in meeting present and future transportation requirements, and what portions of the existing privately owned street railway systems, if any, should be acquired by the City to be used in connection with the Municipal Railway system for providing a unified street railway, and the operating results which might be expected under municipal operation of such a unified system, from the point of view of both service to the public, and finances; together with any alternative method or plan for meeting the transportation requirements other than purchase of the properties by the City.

Section 2: The City Engineer and the City Attorney jointly are hereby authorized and empowered to make a valuation of the properties of the California Street Cable Railroad Company and the Market Street Railway Company, both as a whole and as to such parts thereof, as the City Engineer reports are necessary or desirable for acquisition by the City.

Section 3: The City Attorney is hereby authorized, empowered and directed to make the necessary studies of the legal questions involved in the transportation problems, and to recommend and prepare the legislation necessary or advisable to facilitate the solution of the railway problem.

Section 4: The City Engineer and the City Attorney jointly are hereby authorized, empowered and directed to enter into preliminary negotiations with the California Street Cable Railroad Company and the Market Street Railway Company looking toward the possibility of the acquisition of the whole or parts of these privately owned systems.

The above letter and ordinance give a clear outline of the proposed method of attacking the problem. This, indeed, had been recommended by this office at various times in the past. It is expected that the ordinance will be speedily passed in substantially the form presented above and that by the end of the calendar year we will be in possession of a report that will point the way to a solution of San Francisco's transportation problems.

As can be seen, the valuation of the properties is only a part of the problem. In the case of the Market Street Railway this work will consist of bringing up to date a valuation made by this office in 1921. The

inventory used in that valuation will be the base for the new work making it unnecessary to make a complete field inventory. In the case of the California Street Cable Railroad it will be necessary to make a complete inventory before valuing the property, as even the company has no records of the property which it possesses. There are approximately eleven miles of single track all of a fairly uniform type of construction, and only a few cars, also all very similar, and as the other property consists largely of a power house and car house the work of inventory is not complicated.

Franchises:

The status of the franchises of the Market Street Railway Company is extremely involved. The system has grown by the consolidation of a number of independent lines, many of which occupy portions only of the routes specified in their franchises. On some streets two or more coincident or overlapping franchises expiring at widely separated dates, have been granted to as many different companies. Portions of the present Market Street Railway lines have been operated for a number of years with apparently no franchises, and others are operated under temporary permits. In the case of some of the most important portions of the system there is a difference of opinion as to the dates of expiration of the respective franchises.

As a start toward clearing up the franchise situation the following resolution was adopted by the Board of Supervisors on December 5, 1927:

"Resolution No. 28148 (New Series) as follows:

WHEREAS, it is claimed by the holders of certain franchises to operate street railways on and over the streets in San Francisco, that said franchises do not expire until various dates in the year 1932; and

WHEREAS, it is claimed by the City and County of San Francisco that said franchises will expire during the year 1929; and

WHEREAS, it is a matter of great moment and importance that the correct dates of the expiration of said franchises should be determined at the earliest possible date; now, therefore, be it

RESOLVED, That the City Attorney be and he is hereby authorized and directed to institute legal proceedings under the section of the Code of Civil Procedure providing for declaratory relief, to the end that a legal determination may be had as to the exact dates of the expiration of said franchises hereinbefore referred to; and be it

FURTHER RESOLVED, that the City Attorney be further requested to institute and prosecute said litigation with all possible speed."

In accordance with these instructions the City Attorney on June 26, 1928, filed a petition (Action No. 196,618) in the Superior Court for a declaratory judgment.

On September 19, 1927, the Supervisors passed a resolution No. 27,804 employing the late Delos F. Wilcox to make a report of franchises and properties of the privately owned street railways, to be submitted within sixty days. This resolution was vetoed by the Mayor, but was passed over his veto on October 10, 1927. Under date of November 1, 1927, a report designated as "preliminary" was submitted by Mr. Wilcox to the City Attorney. The time allotted was obviously too short to permit of anything but a sketchy report and, although Mr. Wilcox, since deceased, had gathered together a lot of data more or less useful and presented it in a well arranged form, there still remains the need for more extensive study as outlined above.

Extensions to Municipal Railway System:

In the last Annual Report are listed a number of proposed extensions to the Municipal Railway System for which a proposed bond issue was submitted to the voters and defeated on June 14, 1927. The subject was considered of such importance that on August 17, 1927, the following report was submitted to the Board of Supervisors:

"To the Honorable

The Board of Supervisors of the

City and County of San Francisco.

Gentlemen:

On July 5, 1927, your Honorable Board adopted Resolution No. 27,449 (new series) in which you requested the City Engineer to submit to your Board a report of his recommendations covering the necessary extensions to the Municipal Street Railway System. In conformity with this request, I submit the following report:

On November 6, 1926, in response to Resolution No. 22789 I submitted to your Board a report recommending certain necessary Municipal Railway extensions. Those recommendations covered the Marina Line, Balboa Street Line, Taraval Street Line, the Excelsior Line, Sunset Car Barn, Car Shop, Bus Garage and the purchase of a number of automobile buses. To these recommendations your Board added for inclusion in the bond issue, the Sunset-Parkside connection and the Eureka Valley Line. All of the above projects are included in the following report together with a line on Turk Street providing for the extension of the Balboa Street Line down Turk to Market.

The track construction for the Sunset Line included in the November report, has already been taken care of through an appropriation from the old Municipal Railway Depreciation Reserve Fund. It is necessary to build the car barn in the Sunset and replace the cars recently purchased for the improvement of service on other lines and allocated to the Sunset Line. The cost of these is included in this report.

The track and structures to be built and the necessary lands and equipment to be purchased are shown on the attached table entitled "Estimated Cost of Railway Extensions." There is also attached hereto a map of the City and County of San Francisco showing the locations of these various improvements.

The several extensions and other items tabulated are discussed below in detail. The number assigned to each paragraph corresponds with the item in the tabulation and the numeral indicating the position on the map.

1.—Marina Line

The section of the City utilized as the site of the Panama-Pacific International Exposition has been subdivided, the streets have been paved and many homes have been constructed, resulting in the building up of a very attractive and substantial residential district. A portion of the district lying along the Bay Front has been developed as a Yacht Harbor, attracting many people on holidays. Part of this territory is at the present time served by an extension of the Market Street Railway Company's Fillmore Street hill line. The "F" line of the Municipal Railway runs along the south side of the tract on Chestnut Street. It is proposed to extend this line a distance of approximately .86 mile northerly along Divisadero Street, which would reach not only the residents of the westerly end of the district, but also the Marina Park, the Fine Arts Building and Yacht Harbor.

The track construction will cost \$85,000 and the three additional cars required for extending this service will cost \$58,000, a total of \$143,000.

2.—Balboa Street Line

The southerly portion of the Park-Presidio or Richmond District is at the present time without adequate railway service. There are lines one block apart on Geary, Clement and California Streets, serving the northerly portion of the district, but from Geary Street southerly to Fulton Street, a distance of half a mile there are no street railways. This condition should be remedied, and the construction of a line on Balboa Street with the contemplated extensions on Turk Street to Market will give this section a direct service and provide additional capacity for the growth of the Geary Street service.

The proposed line will have a connection with the present Municipal Railway tracks on Masonic Avenue at Turk Street, and on 33rd Avenue with the present "B" line. Initial operation will be from Geary Street southerly on Masonic Avenue to Turk Street, thence westerly on Turk Street to Arguello Boulevard, thence to Balboa Street and westerly on Balboa Street to 33rd Avenue, requiring 2.54 miles of new double track costing \$355,000. In order to provide for crossing the depression at 23rd Avenue on a reasonable grade, an additional \$100,000 will be necessary. Six additional street cars will be required at a cost of \$115,000, making the total cost for the proposed Balboa Street Line \$570,000.

3.—Turk Street Line

Balboa Street Line as above indicated will initially operate from Masonic Avenue and Geary Street to the downtown district over Geary Street. A more direct service can be given the district served by the extension of the Balboa Street Line from Turk Street and Masonic Avenue easterly on Turk Street to Market Street, there connecting with the Municipal Railway tracks. At the present time the Market Street Railway owns and operates a single track line on Turk Street from Market Street to Divisadero. The franchise for this line expires in the Fall of 1929. Another franchise was granted on June 3, 1892 for a period of fifty years covering the construction of a line on Turk Street from Fillmore Street westerly and out through the Richmond District via Balboa Street to 19th Avenue. The company, however, has never availed itself of this franchise.

The estimate provides \$309,000 for the construction of a new double track on Turk Street from Market Street to Masonic Avenue, there connecting with the Balboa Street line covered by item No. 2. \$25,000 is included for grade revision between Divisadero and Baker Streets. Four additional street cars costing \$77,000 will be required, making a total of \$411,000. The construction of this line upon the franchise expiration,

or sooner if satisfactory arrangements can be made with the Market Street Railway Company, will provide a greatly improved service for the southerly half of the Richmond District and provide additional capacity on Geary Street.

4.—Sunset-Parkside Connection

On account of the contemplated rapid development in the Sunset District between Judah Street and Taraval Street lines, it has been urgently requested that provision be made for the construction of a cross-town line between Judah Street and Taraval Street. It is not the intention to construct this line until such time as the development of the district will necessitate the service. There is included in the estimate \$180,000 for track, \$77,000 for equipment; a total of \$257,000 for 1.3 miles of track and four street cars.

5.—Taraval Street Extension

It is proposed that an extension of the Taraval Street line of the Municipal Railway be made southerly from Taraval Street and 46th Avenue to a loop terminal conveniently located to the Municipal Swimming Pool and Playground near the junction of Sloat Boulevard and the Great Highway. This district is growing very rapidly and many people visit the playground and swimming pool.

In the construction of the streets recently paved, provision has been made for the installation of railway tracks. The cost of the extension will be \$65,000.

6.—Excelsior Line

On June 14, 1927, the citizens voted \$1,400,000 of bonds for the construction of the Bernal Cut. This will open up a new route to the southerly part of town from the present terminus of the Church Street line of the Municipal Railway at 30th and Church Streets and the extension of the Church Street line via existing streets to the Bernal Cut, thence through the proposed cut and over a proposed new street or private right-of-way to and across Mission Street into the Excelsior District to a terminus at or near Geneva Avenue will provide rapid transportation between the Excelsior District and Market Street shopping and business districts.

The territory which will be served is quite extensive, and has never had adequate transportation and for that reason its development has been greatly retarded. The proposed line would have a length of 2.78 miles, requiring an expenditure of \$350,000 for track construction. \$75,000 will be necessary for lands and grading; \$192,000 will be necessary to purchase ten additional cars, making a total of \$617,000 for this extension.

7.—Eureka Valley Line

Your Honorable Board has by resolution promised an extension into the Eureka Valley District as one of the first to be added to the Municipal Railway System. I am including the sum of \$1,085,000 for the construction of a line 1.6 miles long made up of the following items: Track and grading, \$600,000; land, \$255,000; 12 street cars, \$230,000. It is proposed to run from the Municipal Railway tracks at Market and Castro Streets westerly along the Market Street extension to Eureka Street, thence southerly over Eureka Street or other most feasible route to 23rd Street, thence via the most feasible route to a terminus on Diamond Street near 29th Street.

8.—Potrero Hill Bus Line

The Potrero Hill district lying east of Potrero Avenue and south of 17th Street is without transportation of any kind. This is a populous

district and recent street work has made it possible to operate automobile buses into the district.

The proposed route will be 1.1 miles in length, connecting with the Municipal Railway on Potrero Avenue at 17th Street, thence over the most suitable route to the vicinity of 23rd and Wisconsin Street.

Three automobile buses costing \$28,500 will be necessary.

9.—Sunset Car Barn

The installation of service on the Sunset-Duboce route will possibly require the use of 30 street cars, which number will have to be increased as the district develops and as extensions are made to the street railway in the district. In the interest of economy of operation, it is necessary that provision be made for storage and inspection of these cars at a car barn reasonably close to Judah Street, thus avoiding the cost of running these cars to either the Potrero car house or to the Geary Street car house, both of which are at the present time occupied to their full capacity.

I have included \$125,000 for land and \$275,000 for the erection of a permanent building sufficient to meet the railway needs for the next eight or ten years, a total of \$400,000.

10.—Car Shop

One of the most urgent necessities for the continued satisfactory operation of the Municipal Railway lines is the construction of a shop in which cars, buses, and trucks can be overhauled, repaired and painted, and maintenance of way materials cared for. A small shop was provided in the original Geary Street car barn to take care of the 43 cars built out of the original Geary Street bond issue. At the present time the railway forces are striving to maintain 224 passenger cars, 6 work cars, 19 automobile buses, and 8 automobiles and trucks in the original car house shop. A certain amount of shop work is also necessary on track and overhead maintenance. Under present conditions it is impossible to do the work economically and efficiently. It is imperative that adequate shop facilities in keeping with the property which we are now operating be provided at once.

There has already been secured under Resolution No. 20,885 half of the block immediately westerly from the Potrero Avenue car house. The remainder of this block should be secured and York Street which lies between this property and the car house be closed, thus making available two square blocks which can be used exclusively for the Municipal Railway. In addition to providing a car repair shop, this ground will make it possible to store rails, ties and other materials now being carried at the Municipal Pipe Yard where they are not accessible from the electric railway lines. Spur track facilities are available at this location so that materials may be switched directly from the steam roads into our property. It is estimated that the property will cost \$70,000 and the building \$200,000—a total of \$270,000.

11.—Bus Garage

This garage is as important to the maintenance of automobile buses as the car shop is to the repair of street cars. At the present time the railway has no place for automobile buses. The 19 buses now in service are garaged on the public street at a considerable expense over and above what would be necessary to properly care for them under proper cover.

A portion of the space on the second floor of the present Potrero Avenue car barn can be advantageously converted into a garage, bringing together at the Potrero site, car barn, bus garage, shop and material

yard, thus concentrating most of the facilities under the charge of the Master Mechanic at one location.

It is estimated that the cost of providing this garage space will be \$80,000.

12.—Additional Cars

There were recently purchased 15 street cars which were to have been used in the improvement of the Municipal Railway service on the "A", "B", "C", "J", "K" and "L" lines. On account of the failure of the bond issue to pass in June, 1927, these 15 cars, together with 10 additional cars now under construction, will be used in operating the Sunset-Duboce line, so that they will not be available for improving the service on the older lines mentioned above. It is important that this additional service be given as with the normal growth of business the present number of cars does not provide adequate service over the morning and evening peaks.

It is therefore urgently recommended that 15 additional cars be purchased which will provide better service for the "A", "B", "C", "J", "K" and "L" lines and permit of operating the originally contemplated service on the Judah Street line which the 25 cars allocated to this line will not do.

13.—Automobile Buses

Provision has been made in the estimate for the purchase of automobile buses to the extent of \$66,500. This will permit of purchasing additional equipment for the improvement of service on existing lines, also the establishment of one or two bus routes of short length where it may be found necessary to give bus transportation until conditions warrant the more permanent installation of car tracks.

The above projects together with additions and betterments involve a total expenditure of \$4,600,000. Funds for this work can only be provided through a bond issue. It has been suggested that this be submitted to the people at the general election on November 8, 1927. If your Board should decide to place this proposition on the ballot on that date, prompt action must be taken to pass the necessary legislation as the minimum time required is approximately 60 days from the passage of the declaratory ordinance until the time that the election can be held. The intervention of holidays in the early part of September will add materially to this period.

The extensions included are not all that are needed to provide proper service to those districts now without service or inadequately served.

It is felt that this report, however, provides for those districts which are in most urgent need of additional transportation facilities and at the same time does not call for the construction of any trackage which will not be necessary or desirable, however the Market Street Railway expiring franchise problem is solved.

Respectfully,

M. M. O'SHAUGHNESSY,
City Engineer."

ESTIMATED COST OF RAILWAY EXTENSIONS:

	Route Miles	No. of Cars	Track	Land	Buildings and Miscel.	Equipment	Total
1. Marina Line .....	.86	3	\$ 85,000	.....	.....	\$ 58,000	\$ 143,000
2. Balboa St. Line	2.54	6	355,000	.....	\$100,000	115,000	570,000
3. Turk Street Line	2.10	4	309,000	.....	25,000	77,000	411,000
4. Sunset-Parkside Conn.	1.30	4	180,000	.....	.....	77,000	257,000
5. Taraval St. Extension .. ...	.63	....	65,000	.....	.....	.....	65,000
6. Excelsior Line	2.78	10	350,000	75,000	.....	192,000	617,000
7. Eureka Valley Line	1.60	12	600,000	255,000	.....	230,000	1,085,000
8. Potrero Hill Bus Line.....	1.10	3	.....	.....	.....	28,500	28,500
9. Sunset Car Barn .....	....	....	.....	125,000	275,000	.....	400,000
10. Car Shop .....	....	....	.....	70,000	200,000	.....	270,000
11. Bus Garage .....	....	....	.....	.....	80,000	.....	80,000
12. Additional Cars .....	....	15	.....	.....	.....	288,000	288,000
13. Automobile Buses .....	....	....	.....	.....	.....	66,500	66,500
<hr/>							
Engineering, contingencies, etc.							\$4,281,000
Total.....							\$4,600,000

This proposition as outlined above, submitted to the voters at the general election on November 8, 1927, was likewise defeated, the final vote being: Yes, 68,484; No, 49,965.

Inasmuch as the Railway has no funds with which to make extensions this action by the voters has, for the time being, brought to a standstill the growth of the Municipal System, and leaves many important sections of the City without necessary transportation.

Sunset Line:

As stated in the above report, funds sufficient for the completion of the Sunset Line were provided out of the Municipal Railway Old Depreciation Fund, and, except for the Sunset Car Barn, this project was not affected by the failure of the bond issue. All the material for the line has been purchased, and the various contracts for different portions of the work are either under way or completed.

The people of the Sunset District, the contractors, and this office have been seriously inconvenienced by an injunction suit (Hunt vs. Boyle) brought after a large part of the work had been completed, and directed specifically against the contract for the construction of the track work and paving, work on which was just getting under way. The complaint was filed October 6, 1927, and judgment in favor of the City rendered in the Superior Court on December 16, 1927. The case was appealed, and on May 7, 1928, the California Supreme Court affirmed the decision of the lower Court. On May 15, 1928, the judgment was made final by the parties to the suit entering into a stipulation whereby the appellant waived the right to petition for a rehearing. Work was immediately resumed and is now progressing satisfactorily. The line will be ready for operation of cars early in the Fall, after various delays amounting to approximately a year.

On Duboce Avenue from Church Street to Fillmore Street and on Carl Street from near the west Portal of the Tunnel to Stanyan Street, the route coincides with existing tracks of the Market Street Railway Company. The question of the joint use of this trackage has been the subject of considerable correspondence and negotiations between the City Engineer and the Railway Company, and an approximate valuation was made of the property to be so used. A tentative agreement was finally reached whereby the City would pay the Railway Company the sum of \$550 annually, plus a charge of 7½ cents per car mile to cover electric energy and maintenance. Copies of this agreement, together with a draft of a proposed resolution authorizing its execution, were transmitted by this office to the Board of Public Works on June 23, 1928, with a request that it be presented to the Board of Supervisors for early action. The execution of this agreement will remove the last obstacle in the way of completion of the line.

Embarcadero Bus Line:

This bus line, which was placed in service on January 27, 1927,

between the Southern Pacific Company's Third and Townsend Streets Station and the Golden Gate Ferry Slip at the foot of Hyde Street, has been continued in operation, giving a convenient service along the Embarcadero to Water Front employes and others. Although operated on a straight 5-cent fare without transfers, this line, like the other bus lines of the Railway, in spite of the optimistic predictions of its proponents, does not meet expenses.

Following is a statement of operating results for the past fiscal year:

Gross Operating Revenue		\$37,635.03
Operating Expenses:		
Equipment	\$ 8,284.11	
Conducting Transportation	21,428.30	
General Miscellaneous	4,734.60	34,447.01
Excess Receipts over Operating Expenses.....		\$ 3,188.02
Reserves and Interest:		
Depreciation	\$ 5,469.68	
Insurance	3,535.87	
Interest	2,557.05	11,562.60
NET LOSS		\$ 8,374.58

The buses on this line carried a total of 752,981 passengers, an average of a little over 2,000 passengers per day.

At the request of some industries west of Third and Townsend Streets Station the route was extended on March 26, 1928, to Tenth Street and Potrero Avenue. In view of the contract with the Harbor Commission, wherein the Commission assumes a portion of the line's losses, the consent of that body was necessary before this extension could be made. Their tentative approval was granted with the understanding that the extension was to be operated experimentally and its continuance would depend upon its financial outcome. The additional service produced a rapid increase in operating losses and, at the request of the Harbor Commission, it was discontinued on May 6, 1928.

Marina Bus Line:

The needs of the Marina District were considered in the proposed bond issue described above, and the so-called "Marina Line," described as No. 1 in the list of projects, would have given the district excellent service. Pending the outcome of the proposed bond issue temporary service was given the people of this district by the operation of a single bus from the end of the "F" line to the Marina Boulevard. This line, which started operation on August 29, 1927, ran at a loss. In spite of the very limited patronage which it received, the attempt to discontinue the line met with severe local opposition so that on June 11, 1928, the Board of Supervisors, by Ordinance No. 8075, directed its continuance for a period of 90 days.

Car Shops and Garage:

No relief is as yet in sight from the severe handicap placed on the

Railway through lack of adequate shop and garage facilities. The garage situation in particular is very bad, as has repeatedly been pointed out by this office. The buses are parked at night along Presidio Avenue exposed to the elements and constituting a menace to traffic.

It seems practicable to utilize some of the space of the unfinished portion of the second floor of the Potrero Car Barn for the construction of a garage which would serve the present needs of the Railway and a \$50,000 appropriation has been requested from the Board of Supervisors to proceed with its construction.

Material Yard:

The Railway must always have on hand a certain amount of material for construction and maintenance of track and overhead. At the present time the only available space for the storage of this material is at the Municipal Pipe Yard at Sixth and Hubbell Streets. This yard, while sufficiently large and provided with spur tracks, has several drawbacks which would make it advisable to abandon it in favor of a location more suitable from the standpoint of the railway.

The use of the block immediately west of the Potrero Car Barn has been proposed for this purpose and for the erection of a car shop and it is hoped that whenever funds are available it may be fitted up and used for these purposes.

West Portal Avenue:

The tracks on West Portal Avenue from the Twin Peaks Tunnel westerly were originally constructed of 70-lb. tee rail laid in what was conceded to be a private right-of-way, separated by concrete curbs from the street pavement on either side. This construction was adopted in anticipation of a future rapid transit line into San Mateo County. Due to the growth of the district west of the tunnel, and the development of a business district on West Portal Avenue with the resulting congestion of automobile traffic, the Railway has been forced to allow the reconstruction of this track with girder rail and pavement. The work improves conditions insofar as street traffic is concerned, but will seriously impair the future use of the track as a high speed line.

Equipment:

The contract for 15 new street cars mentioned in the last Annual Report, provided that, at the option of the City, the number of cars furnished might be increased to a maximum of 30. The Board of Public Works exercised this option by purchasing bodies and equipment for ten additional cars, which have all been delivered and placed in service.

It is expected that, with this additional equipment, the Railway will have enough cars to operate the Sunset Line when completed. During the rush hours the proposed service will require practically every usable car, and the margin of necessary spares will not provide for increased service on any of the other lines.

CURRENT CONTRACT DATA—1927-1928
Applying to City Pay Contracts and Major Contracts Involving City Funds.

Description	Contractor	Awarded	Completed Date	Completed %	Amount Complete	To 6/30/28	Fund
Boulevards, Paving and Grading							
Peralta St., York to Holladay and Tomasa, Peralta to Montcalm, (Paving, Walls, etc.)	M. J. Treacy	8/ 9/26	11/30/27	100	\$33,126.10	\$14,955.00a	General Fund and Public Assessment
Market St. Extension, Mono to Ord, Sec. B, (Contract No. 1, Paving, Walls, etc.)	Jas. M. Smith	8/20/26	10/27/27	100	102,566.36	102,566.36	County Roads
Elk St., Bosworth to Chenery, Contract No. 1 (Grading)	Eaton & Smith	9/17/26	10/21/27	100	2,283.28	2,283.28	General Fund
Golden Gate Heights (Grading, Walls, etc.)	A. E. Hennessey	9/22/26	12/21/27	100	455,418.73	32,104.26ac	County Roads and Public Assessment
Elizabeth St., Hoffman to Burnham, (Paving, Walls, etc.)	T.M. Gallagher	9/22/26	7/20/27	100	13,639.23	6,300.00a	General Fund and Public Assessment
Turk St., Masonic to Parker, (Paving)	A. E. Hennessey	10/27/26	10/26/27	100	45,828.26	35,828.26b	County Roads and Special Funds
Vermont St., 20th to 22nd, (Grading, Walls, Paving)	Federal Construction Co.	1/ 7/27	3/ 3/28	100	37,552.22	19,715.04ac	County Roads and Public Assessment
Castro St., 29th to 30th, and 30th St., E-ly from Castro, (Grading, Walls, etc.)	Jas. M. Smith	2/ 4/27	9/ 7/27	100	11,618.90	11,618.90	County Roads
Grand View Ave., Elizabeth to Stanton, (Grading, Walls, etc.)	Schultz Construction Co.	3/18/27	1/11/28	100	59,437.35	59,437.35	County Roads
San Jose Ave., Gorham to Cotter, (Widening)	Chas. L. Harney	3/23/27	11/ 1/27	100	7,222.09	7,222.09	County Roads
Great Highway, W-ly half, Ulloa to S-ly termination, (Paving)	L. J. Cohn	4/ 6/27	8/ 3/27	100	10,555.85	10,555.85	County Roads
Bay St., Laguna to Fillmore, (Grading, Paving, etc.)	Federal Construction Co.	7/15/27	3/13/28	100	19,899.57	16,626.80b	General Fund, County Roads & Special Funds
Montgomery St., Green to Union, (Grading, Walls, Paving)	Fay Improvement Co.	9/14/27		98	18,586.02	7,256.52	County Roads and Property Owners
San José Ave., Cotter to Capistrano, and Havelock to Ottawa, (Widening and Paving)	E. J. Treacy	10/14/27	6/13/28	100	26,613.44	23,718.89	County Roads

Contract amounts, in parenthesis (.....) are based on estimated quantities, b. Balance paid from special funds deposited by property owners.

Boulevards, Paving and Grading—Continued							
Roosevelt Way, Buena Vista Ter. to 17th, (Paving)	C. B. Eaton	10/28/27	6/12/28	100	\$66,548.01	\$37,500.00	County Roads and Public Assessment
Judson Ave., Foerster to Phelan, S-ly half, (Paving)	A. G. Raisch	1/27/28	6/19/28	100	3,833.00	3,833.00	County Roads
Holladay Ave., Peralta to Adam, (Grading, Walls, Paving)	Schultz Construction Co.	2/10/28		100	32,564.98	16,200.00	County Roads
Alemanay Blvd., Sec. B, Mission to Ocean Ave., Cont. No. 4, (Paving)	Eaton & Smith	3/ 9/28		23	(106,763.41)	15,900.00	Boulevard Bonds
Bay Shore Blvd., Sec. B, Silver to Paul, Cont. No. 3, (Paving)	Federal Construction Co.	3/15/28		7	(139,909.58)	2,100.00	Boulevard Bonds
Portola Drive, Teresita to O'Shaughnessy Blvd., (Widening and Paving)	Pacific States Const. Co.	3/23/28	6/ 5/28	100	16,485.40	16,485.40	County Roads
Parker Ave., California to Euclid (Widening and Paving)	Fay Improvement Co.	3/26/28		100	4,122.73		County Roads
Bay Shore Blvd., Sec. A, Potrero to Silver, Cont. No. 6, (Paving)	Louis J. Cohn	6/11/28			(224,347.98)		Boulevard Bonds
Sewers							
Westerly Sunset Dist. Sewer, Sec. B, 43rd Ave. Main	Frank J. McHugh	10/15/26	4/24/28	100	155,860.50	155,860.50	General Fund
Noriega St. Sewer, 24th to 29th Ave.	Manuel Smith	2/18/27	7/ 2/27	100	11,240.00	11,240.00	General Fund
Fleishacker Playfield, Sanitary Sewer	Louis J. Cohn	5/20/27	8/24/27	100	3,054.00	3,054.00	General Fund
Canal St. Sewer Ext., Cont. No. 3	Jas. M. Smith	6/17/27	8/ 3/27	100	3,746.00	3,746.00	General Fund
Stanley St. Sewer Ext., Charles Ave. to Junipero Serra Blvd.	Jas. M. Smith	6/17/27	1/ 3/28	100	6,833.79	6,833.79	General Fund
30th Ave. Sewer, Sunset Dist., Cont. No. 5	Federal Construction Co.	8/ 7/27		99	28,989.00	28,700.00	General Fund
Fillmore St. Main Sewer, Cont. No. 1, Sec. A, 10th St., Harrison to Division St.	Clarence B. Eaton	2/20/28		45	45,823.29	9,000.00	General Fund

Contract amounts in parenthesis (.....) are based on estimated quantities.

Bay Shore Blvd. Storm Drain, Cross- ing Alenany Blvd., Cont. No. 2	Louis J. Cohn	3/ 2/28	49	(\$59,594.40)	\$21,600.00	Boulevard Bonds
Laguna Honda Blvd. Sewer	C. C. W. and H. H. Haun	4/25/28	8	(\$29,290.85)		Gen. F'd. & Co. Rds.
Wawona St. Sewer, 25th to 34th Ave.	Frank J. McHugh	5/18/28		24,331.51		General Fund
Guttenberg St. Sewer	Hugh McGill	6/11/28		7,245.76		General Fund
Miscellaneous						
Sunset Tunnel (Duboce Ave. Route)	Yondall Const. Co.	5/10/26	100	(1,301,199.01)	1,286,871.51	Assessment Fund
Safety Zone Buttons, Cont. No. 1, (Installation)	E. J. Treacy	6/ 2/26	100	4,255.95	4,255.95	General Fund
Sutro Monument & Grounds (Imp'v't)	Eaton & Smith	10/ 5/26	100	13,932.27	13,932.27	General Fund
Safety Lane Markers, Cont. No. 2, (Installation)	L. M. Neil	1/12/27	100	5,308.19	5,308.19	General Fund
Street Signs, Cont. No. 7	T. M. Gallagher	9/23/27	100	8,287.50	8,287.50	General Fund
Auxiliary Water System, Ext. No. 6	C. B. Eaton	11/ 4/27	100	42,788.61	38,400.00	General Fund
Pedestrian Tunnel Extensions, under Skyline Blvd. at Fleishacker Pool	L. J. Cohn	1/13/28	97	14,092.58	13,650.00	Co. Rds. F'd.
Sewage Pumping Plant, Pinelake P'k.	Ajax Const. Co.	1/13/28	100	2,567.00	2,567.00	General Fund
3rd Street and Channel Bridge: Fender Piling	A. W. Kitchen	3/ 2/28	100	1,182.00	1,182.00	Co. Rds. F'd.
Tie Rod Anchorage	L. J. Cohn	1/27/28	99	12,521.12	10,975.00	Co. Rds. F'd.
Fender Piling Repairs	Renner Foundation Co.	6/18/28	50	1,400.00		General Fund
Municipal Airport (Mills Field): Cont. No. 2, Water, Drainage, Mark'g	Latourrette-Fical Co.	4/ 1/27	100	8,969.13	8,969.13	General Fund
Cont. No. 4, Hangar No. 1	Roy Lind	4/ 8/27	100	23,664.06	23,664.06	General Fund
Cont. No. 5, Hangar, Field Lighting	Latourrette-Fical Co.	4/ 8/27	100	7,120.45	7,120.45	General Fund
Cont. No. 7, Floodlight Housing and Meteorological Station	F. W. Varney	5/13/27	100	1,576.20	1,576.20	General Fund
Cont. No. 8, Grading, Filling De- pressions and Runways	Jas. M. Smith	7/ 1/27	100	(40,000.00)	26,400.00	General Fund
Cont. No. 9, Hangar No. 2	Stephenson Const. Co.	9/12/27	85	(101,600.00)	56,625.00	General Fund
Cont. No. 10, Comfort Station	Peter Sorensen	1/13/28	100	2,932.00		General Fund
Esplanade, Sec. E, Ocean Beach	Healy-Tibbitts Con. Co.	3/ 2/28	27	(329,948.00)	25,500.00	Boulevard Bds.

(Contract amounts in parenthesis (.....) are based on estimated quantities.

CURRENT CONTRACT DATA—1927-1928

No.	Description	Contractor	Awarded	Completed Date	Completed %	Amount Complete	Amount To 6/30/28	Fund
Municipal Railways								
149A	Street Car Bodies	St. Louis Car Co	11/26/26	4/ 6/28	100	\$241,702.75	\$241,702.75	Mun. Ry. Deprec'n
149B	Street Car Trucks	J. G. Brill Co.	8/25/26	4/ 9/28	100	47,249.38	47,249.38	" "
149C	Street Car Motor Equipment	Westinghouse Elec. & Mfg. Co.	8/ 6/26	5/11/28	100	154,892.00	154,892.00	" "
149D	Street Car Air Brake Equipment	Westinghouse Traction Brake Co.	10/ 1/26	4/ 9/28	100	15,190.94	15,190.94	" "
150A	Track Materials, Girder Rail and Fastenings	U. S. Steel Products Co.	12/ 1/26	8/20/27	100	87,340.20	87,340.20	" "
150D	Track Materials, Track Bolts	Bethlehem Steel Co.	12/ 1/26	8/29/27	100	2,239.00	2,239.00	" "
152	Track Special Work	U. S. Steel Products Co.	2/25/27	9/14/27	100	42,897.10	42,897.10	" "
154	Reinforced Concrete Trolley Poles	Robert W. Jamison	7/ 1/27	5/ 8/28	100	32,685.87	32,685.87	" "
155	Construction of Sunset Line	Faton & Smith	9/30/27		34	(250,000.00)	6,390.00	" "
156A	Electric Cables, Lead Covered	American Brass Co.	6/ 3/27		60	10,542.84	5,250.00	" "
156B	Electric Cables, Rubber Insulated	Standard Underground Cable Co.	6/ 3/27	11/ 1/27	100	2,177.98	2,177.98	" "
156C	Electric Cables, Weather-proof and Bare	Pacific States Elec. Co.	6/ 3/27		88	8,464.45	8,036.05	" "
157	Underground Conduit Material	Graybar Electric Co.	6/17/27	8/20/27	100	6,015.20	6,015.20	" "
158	Installing Electric Conductors & Apparatuses	Robert W. Jamison	8/26/27		90	(21,000.00)	15,000.00	" "
159	Iron Castings	Enterprise Foundry Co.	9/ 7/27	11/22/27	100	1,342.71	1,342.71	" "
160	Rail Bonds	Robert W. Jamison	9/30/27		22	10,369.51	900.00	" "

Contract amounts in parenthesis (.....) are based on estimated quantities.

HETCH HETCHY WATER SUPPLY

Progress and Development

The fiscal year, July, 1927, to June, 1928, recorded gratifying progress in construction of the Foothill Division Tunnels and of the Coast Range Shafts. Operation of Moccasin Power Plant and of the Bay Crossing Pipe Line continues satisfactorily. The approval by the citizens of two bond issues, the one for \$24,000,000 for the completion of Hetch Hetchy Aqueduct and the other for \$41,000,000 for acquisition of the Spring Valley Water Company's properties, provides a definite policy for completion and future operation of a combined water system.

In the **Foothill Division** tunnel driving was carried on in the eight headings already begun in the previous year, also at two new headings opened at the portal camps, Moccasin and Oakdale. During the year 32,659 feet of tunnel were driven, making a total to date of 80,606 feet, which is 96 per cent of the total tunnel in the division. At the close of the year driving had been completed for all headings except the one east from Brown Adit and the one west from Moccasin Portal where 3016 feet of tunnel yet remains to be driven. Preparations are practically complete for placing the concrete lining of the tunnel.

The letting of portions of the work by contract stimulated a spirit of rivalry between the City's forces and the Contractor's forces, resulting in rapid progress and in one case in the breaking of the United States record for tunnel driving. City forces in the west heading at Hetch Hetchy Junction drove 803 feet in the month of September, 1927.

Work at the downstream dam of the Moccasin re-regulating reservoir was carried on according to schedule.

In the **Coast Range Division** through the Livermore Hills work was carried forward on the five shafts. Of these five shafts, four are now down to tunnel grade, and rock pockets and sumps are practically complete so that tunnel driving may be started very shortly. The camps at Alameda Creek and at Tesla Portal are also about ready so that tunnel work may be started.

On May 1, 1928, the voters by a vote of 94,859 for, and 11,381 against, authorized an issue of \$24,000,000 worth of 4½% bonds with which to complete the Coast Range tunnels and the San Joaquin pipe line. These bonds are redeemable \$1,000,000 per year beginning in 1938.

A budget apportioning the proceeds of this \$24,000,000 Bond Issue was submitted to the Board of Supervisors on May 25, 1928, and received their approval as to \$15,350,000 for the items covering the Coast Range tunnels. They have deferred approval of the San Joaquin Valley Pipe Line construction amounting to \$8,650,000.

With funds available to continue the construction, it is confidently predicted that the Hetch Hetchy Aqueduct will be completed in 1932.

The **Moccasin Power Development** has been in continuous successful operation delivering electric power over the City's transmission line to Newark for distribution under contract between the City and the Pacific Gas & Electric Company for the fiscal year 1927-1928. The net earnings of the system during the fiscal year available toward payment of bond interest and redemption charges amounted to about \$1,900,000. The aggregate figure for the entire period of operation is over \$5,500,000.

The **Bay Crossing Division** of the Hetch Hetchy Aqueduct has been continued in operation by the Spring Valley Water Company, giving the City an annual rental of \$250,000 and bringing a large amount of water from Calaveras Reservoir to Crystal Springs Reservoir and insuring the City an adequate supply until the completion of the Hetch Hetchy Aqueduct.

By vote of 82,490 for and 21,175 against, the City voted \$41,000,000 worth of bonds to acquire the system of the Spring Valley Water Company. This latter purchase not only gives the City a complete water system with over 100,000 consumers, but provides a large receiving reservoir in San Mateo County and a distribution system in San Francisco for the Hetch Hetchy water.

Organization and Headquarters Work

The Hetch Hetchy Water Supply work continues under the direction of M. M. O'Shaughnessy, City Engineer, assisted by Nelson A. Eckart, Chief Assistant Engineer, as in previous years.

City Headquarters Office:

The City office staff has the same duties as outlined in the last annual report, Page 49. The staff consists of L. W. Stocker, Civil Engineer; P. J. Ost, Electric Engineer; R. L. Allin, Hydraulic Engineer; H. W. Kephart, Purchasing Agent; J. J. Phillips, Right-of-Way Agent; and a number of Assistant Engineers, Draftsmen and Clerical Employees.

R. P. McIntosh, Hydraulic Engineer, passed away January 27, 1928. Mr. McIntosh was a brilliant mathematician and most able designer, and assisted in preparation of the plans for O'Shaughnessy, Eleanor, Priest and Early Intake Dams and the caisson in Dumbarton Strait and other structures on the Hetch Hetchy work calling for the highest degree of ability in design.

E. P. Jones, Mechanical Engineer, was retired on pension February 1, 1928, under the provisions of the San Francisco Employees' Retirement System.

Some of the more important items of City Office work done during the past year are mentioned below:

The main and auxiliary outlet towers, gates and appurtenances for the Moccasin Re-regulating Reservoir were fully designed and drawings

to accompany specifications for the contract for the gates and gate operating equipment were completed. Plans for concrete construction were prepared.

The main dam of this reservoir was partially designed and studies were in progress for the smaller upstream dam at the head of the bypass conduit which is to carry the natural flow of Moccasin Creek. Drawings were made for the portion of the conduit located within the site of the main dam. This portion of the conduit is now constructed.

A review of the hydraulics of the main aqueduct from Moccasin Creek to San Francisco was made in connection with the design of structures for the regulation of the flow of water and for protecting pipe lines and tunnels during operation of aqueduct. A surge shaft was designed, to be constructed on the main aqueduct tunnel east of Red Mountain Bar. An overflow shaft to be built on the main aqueduct tunnel about 1500 feet east of Oakdale Portal was designed to guard against excessive internal pressure. Detail drawings were being made for this shaft at the close of the fiscal year.

Preliminary studies and estimates for a dam and outlet system for the Glen Park Reservoir were made. This is one of three proposed reservoirs to be constructed in San Francisco to provide additional local storage.

Designs were made for concrete lining for the shaft, shaft station, rock pocket and sump at Indian Creek Shaft in the Coast Range Division. All shafts, shaft stations and cross-cut tunnels connecting shafts and main aqueduct tunnels in this division will be permanently lined with concrete for use in constructing the future parallel tunnel. As the year closed designs were in progress for underground stations at other shafts and for the cross-cut tunnel at Indian Creek Shaft.

Descriptions were prepared for deeds and other documents for acquisition of lands for shaft camps and rights-of-way for tunnel, transmission and telephone lines in the Coast Range Division and for the pipe line connecting Irvington Portal and the existing Bay Crossing pipe line. Large scale topographical maps were prepared for each shaft and portal camp in the Coast Range Division and as the year closed combination map and profile drawings were being made for the whole division. These maps will also show right-of-way details and will form a part of the set of final record right-of-way maps planned for the whole system as described in the Annual Report for 1926-1927, pages 50 and 51.

Following the program referred to above, progress for the fiscal year on final real estate records includes the completion of maps for that portion of the right-of-way in San Joaquin Division that was purchased for use as a joint aqueduct and transmission line right-of-way, and the completion of deed books for land and right-of-way transactions in Stanislaus County. Deed books for San Joaquin County were partially compiled for the joint aqueduct and transmission line right-of-way.

Temporary deed books were maintained for current transactions in San Joaquin and Alameda Counties in connection with the acquisition of lands and rights-of-way for tunnels and pipe lines and appurtenant structures in the Coast Range Division and in those portions of the San Joaquin and Bay Crossing Divisions immediately adjacent to the Coast Range Division. These temporary books will be put into permanent record form when all acquisitions are made.

Plans and estimates were prepared in connection with the \$24,000,000 Hetch Hetchy Bond Issue and the \$41,000,000 Spring Valley Bond Issue (passed on May 1, 1928). In addition to the plans and estimates various reports, financial estimates, charts and maps were prepared for use in submitting these bond issues to the people of San Francisco.

No contracts were let during the fiscal year. Plans and specifications are in preparation for Contract No. 119, for furnishing and delivering outlet gates and appurtenances for the Moccasin Re-regulating Reservoir.

Contract No. 113, for the construction of aqueduct tunnels in the Foothill Division, continued in force throughout the year.

The following contracts were completed and final payment and acceptance was made during the fiscal year:

No. 116—for copper wire for the electric transmission line to serve the Coast Range Division construction work.

No. 117—for insulators and pins for the electric transmission line to serve the Coast Range Division construction work.

No. 118—for substation equipment for Seco Sub-Station in the Coast Range Division.

Appended to this report is a table of detail data on current contracts for the year 1927-1928.

The purchasing department handled purchase of miscellaneous materials, supplies, etc., aggregating \$1,777,109 and payments for lands, etc., amounting to \$18,818, during the fiscal year.

Field Headquarters:

At Hetch Hetchy Junction Headquarters, L. T. McAfee, Construction Engineer, is in charge, assisted by the same staff as in the previous year. His office handles not only the work of the Foothill Division but also incidental construction and maintenance jobs on the Mountain Division and the San Joaquin Division. All buildings here are on property under direct control of the City, either bought in fee or leased.

Accounting of the entire Hetch Hetchy activities of the Board of Public Works is under direct charge of Willis O'Brien, Auditor, with offices at Hetch Hetchy Junction and clerical force in each camp.

At Livermore headquarters, C. R. Rankin, Construction Engineer, is in charge. His staff consists of men from the completed divisions of

the work and of specialists transferred from the Foothill Division. Mr. Rankin handles the Coast Range Division construction and also keeps in touch with conditions on the completed Bay Crossing Division.

At Moccasin headquarters, Thornton Easler, Assistant Electrical Engineer, is in charge of maintenance and operation of the power system.

Field Employees:

The number of employees in the field decreased during the fiscal year from 1,042 at the beginning to 800 at the end of the year, due to reductions in the forces in both the Foothill and Coast Range Divisions. In the Foothill Division crews were reduced as tunnel excavation was completed at several working points. Fewer men were used in the Coast Range Division at the end of the year due to the completion of camp facilities and the centralization of operations on shaft construction.

The following table shows the number of men, including the City's field engineering staffs, employed on the various jobs on June 30, 1927, and on June 30, 1928:

	June 30, 1927	June 30, 1928
	Con- struction	Opera- tion
Lake Eleanor Reservoir	1	1
O'Shaughnessy Dam	2	2
Lower Cherry Power System	10	7
Early Intake Diversion Works	2	2
Priest Reservoir	1	....
Moccasin Headworks	2	1
Moccasin Penstocks	2	1
Moccasin Power House	27	24
Moccasin Re-regulating Reservoir	22	***
Moccasin Transmission Line	4	5
Hetch Hetchy Railroad (operation in connection with construction work)	23	12
Foothill Division Aqueduct:		
City Forces	473	289
Contractor's Forces	307	188
Coast Range Division Aqueduct.....	105	228
General and Miscellaneous	57	34
TOTALS	987	751
Totals, construction and operation.....	1042	800

***Included in Foothill Division Aqueduct.

Medical Service:

Groveland Hospital is still maintained under the direction of Dr. J. P. Degnan, assisted by three trained nurses. An assistant physician quartered at Hetch Hetchy Junction, has supervision of the first aid

station. He makes daily trips to the camps of the Foothill Division, carrying on the routine work of examinations, dressings, treatments, etc.

The record of cases treated at the Hospital during the fiscal year is as follows:

Non-Hospital Cases	250
Hospital Cases:	
City Employees	189
Employees of A. Guthrie Co. and T. E. Con-	
nelly (Tunnel Contractors)	114
Outside Pay Patients	64
 Total Hospital Cases	 367
Total Cases Treated	617
Capital Operations	107
Average Time in Hospital for Hospital Pa-	
tients—days	16¼

All employees of the City on Hetch Hetchy work outside of the City are insured in the State Compensation Insurance Fund.

Relations with Department of Interior

The efforts of the City to prevent pollution of San Francisco's Water Supply which would result from throwing open Hetch Hetchy and Lake Eleanor Reservoirs to fishermen have not received the co-operation on the part of the National Park authorities that we were led to expect from the assurances of the Director of National Parks, expressed in a conference at which the subject was discussed.

The Director of Parks, through his publicity bureau, has launched an attack on the City in the columns of the press throughout the State, grossly misrepresenting San Francisco's attitude on its Raker Act obligations toward road construction and ignoring the obligation of the government to carry out the Raker Act provisions to maintain the purity of San Francisco's Water Supply.

The Raker Act under which the City acquired some of the rights within Yosemite National Park provides (Sec. 9-a):

"First, No human excrement, garbage or other refuse shall be placed in the waters of any reservoir or stream or within one hundred feet thereof.

Third, No person shall bathe, wash clothes or cooking utensils, or water stock in, or in any way pollute the water within the limits of the Hetch Hetchy Reservoir or any reservoir constructed by the said grantee under the provisions of this grant, or in the streams leading thereto, within one mile of said reservoir; or, with reference to the Hetch Hetchy Reservoir, in the waters from the reservoir or waters entering the river between it and the 'Early Intake' of the aqueduct, pending the completion of the aqueduct between 'Early Intake' and the Hetch Hetchy Dam site."

The company which enjoys practically a monopoly of the valuable concessions in Yosemite National Park made a determined effort to put pleasure boats on Hetch Hetchy Reservoir. The boats are still stored at

Damsite but the City does not propose to allow them on the reservoir. Nowhere is fishing or boating, with its consequent pollution of water, tolerated on a reservoir storing water for domestic use of a city.

The tourist camp at Mather has been completed so there can be no further excuse for allowing camping at Canyon Ranch Creek which drains into the Tuolumne River between Hetch Hetchy and Early Intake.

The present revival of the controversy was precipitated by a notice from Hubert Work, Secretary of Interior, dated July 7, 1927, the purpose of which notice was to require the City to perform all obligations set forth in the "Raker Act." The notice contained a statement that the City had not complied with the requirements of the grant. Request was made that the City immediately perform specific items of work and convey certain parcels of land to the United States.

The City Attorney under date of October 13, 1927, replied to the Secretary of the Interior, setting forth the City's position. The Department's contention and the City's briefed replies are as shown below:

"The city and county . . . have not complied with the terms of the grant . . ."

The City has never sought to evade its obligations. No formal request was ever made by the Department until this date.

"(a) Widen the present road from Hog Ranch to Hetch Hetchy to a full travelable width of 18 feet and surface said road."

Roadbed is built already to 22 feet width on 4 per cent grade and is now in satisfactory use. Mr. Mather's estimate of the cost of additional work, \$270,000, is equivalent to 31½ cents per square foot, corresponding to an 8-inch concrete surface. The Raker Act, adopted in 1913, calls for a wagon road from Hamilton to Hog Ranch and Hetch Hetchy. It does not require nine miles of road of a higher standard than the roads with which it connects, as in existence at the time of adoption of the Act.

"(b) Build a road from Hetch Hetchy Reservoir to Lake Eleanor via McGill Meadows so as to render the route available for motor travel."

Under date of October 13, 1916, the City submitted to the Department of the Interior, a map of a proposed road, showing alignment and grades. The plans were approved by the Secretary of the Interior, December 30, 1916. The road was constructed and used by the City in hauling 6,000 tons of freight to Lake Eleanor by motor trucks. The grades are superior to those of the Big Oak Flat Road with which it connects. This road was built as one of the obligations of the Raker Act. It was not the intent of the Act to require the City to continually improve the standards of roads which were constructed in conformity with the Act at the time of its adoption.

"(c) Construct a road of not less than 18 ft. in width, and with grades of not to exceed 8 per cent, from Hog Ranch, past Harden Lake to the Tioga Road, said road to be suitable for motor travel."

The City has already advanced \$6,000 to the National Park authorities for surveys for this road. The surveys are being made upon a higher standard than has been set forth in the notice. The City recognizes its obligation to construct a road, but not a road of higher standards than existent on the two main roads to which it connects, viz., the Big Oak Flat Road and the wagon road built by the City from Hamilton to Hog Ranch, and the Tioga Road. If the Government now contemplates constructing a new main highway into Yosemite Valley, of which this road would form a link, the reasonable obligation of the City would be to contribute a sum equivalent to the cost of building a road of the standard that existed on connecting roads at the time of the Raker Act. The City could contribute \$250,000, the estimated cost of such a road.

"(d) Construct a wide and serviceable trail along the north side of Hetch Hetchy Reservoir for the full length thereof."

The City does not question in any way this obligation. Surveys will be made as soon as weather conditions warrant.

"(e) Construct a trail . . . to Tiltill Valley and Lake Vernon."

No exception is taken to their requirement. Surveys will be made at the same time as the surveys contemplated under (d).

"(f) Before proceeding to construction of the works herein required, the City and County must secure approval by the Secretary of the specifications for said works, to be followed by the construction contractor or party as required by Section 9 (p) of the Act, and likewise must secure the formal approval and acceptance of the roads and trails constructed."

It is the contention of the City that all roads and trails heretofore constructed have been constructed subject to the direction and approval of the Secretary of the Interior or the Secretary of Agriculture, according to their respective jurisdictions, and that the general plans were approved by the Secretary of the Interior, and all instructions or directions issued to the City at the time of the construction of the road were observed in the manner of doing the work and carrying out the same. In the future the City will be glad to comply with your request that formal approval and acceptance be secured.

"(g) The Grantee shall make arrangements for the reimbursement of the United States for the actual cost of maintenance of the above roads and trails in a condition of repair as good as when constructed, in accordance with the provisions of section 9 (q) of the Act of December 19, 1913."

The City of San Francisco has at its own cost and expense maintained all roads and trails built by it under the provisions of the Raker Act, except that during the past season Mr. Mather and the Superintendent of the Yosemite National Park requested that they be allowed to maintain the road from Mather to Hetch Hetchy as a part of their road maintenance work. The City has never at any time failed to meet any obligation as to reimbursement of the Government for the maintenance of any of these roads.

With regard to the request for the conveyance of lands as provided by Sections 9 (t) of the Act, the Act reads,

"Shall convey to the United States" title . . . "to any and all tracts of land which are now owned by said Grantee within the Yosemite National Park not actually required for use under the provisions of the Act."

The Department requests the conveyance of six parcels of land listed as a, b, c, d, e, and f. Lands listed under "a" are commonly known as the Canyon Ranch Tract and comprise 160 acres. Proper conveyance to the United States will be made immediately. Items "b" and "c" are the Hetch Hetchy and Lake Eleanor Reservoir lands aggregating 1640 acres. Large portions of them are submerged now, other portions will be submerged upon construction of future additions to the dams, and a small remaining portion lying along the margins of the reservoirs, is necessary for sanitary control of the reservoir. Item "d" covers the McGill Meadow tract of 160 acres and item "e" the Lake Vernon lands of 121.49 acres, both of which were acquired in 1918, four years after the Raker Act and therefore not included in the provisions of the Act. Item "f" refers to Tiltill Valley lands comprising 160 acres. The west 40 acres of this land are required for use by the City in connection with its future operation, and the remaining 120 acres will be conveyed to the United States Government under the provisions of the Act, immediately.

The Hetch Hetchy project is far from complete. \$24,000,000 in bonds must be voted within the next year, after which possibly four years will elapse before water from the Hetch Hetchy can be brought into San Francisco. During this period of construction the City has been and still is under a heavy burden of bond interest. It is the desire of the City that a definite program be mapped out so that the uncompleted obligations may be carried out in such manner and at such time as will avoid at this time large capital expenditures for any roads which are not at present actually required to link up with the Federal or State road program. This letter was transmitted to the Department of the Interior by the City Attorney who had been so empowered by the Board of Supervisors.

Spirited controversy thereupon began—The City was supported by a report of the Attorney of the San Francisco Chamber of Commerce who concurred in the position taken by the City on all items excepting the retention of lands above reservoirs. The Secretary of Interior was supported in most of his contentions by an opinion of the Solicitor of the Department and an opinion of the United States Attorney General.

On May 18, 1928, the Secretary of the Interior again wrote the City requiring fulfillment of road and trail and land conveyance obligations as requested in letter of July 7, 1927. In this he prescribed a program for road building to be followed, covering a four year period. In this letter he conceded many of the points as to lands as raised by the City

so that the matter virtually settled down to the question of the standard of roads to be built.

A conference between City Officials and Department of Interior Officials will be held shortly at which it is expected that a definite understanding will be reached. During this controversy, bitter attacks were made on the City in Congress by a Representative from Michigan, and considerable misleading propaganda was distributed to California newspapers by the Department. The position of San Francisco was ably defended in Congress by the Representatives from the Bay Region.

In compliance with the terms of the Raker Act, and at the requests of the Secretary of the Interior, under date of July 7, 1927, and the Secretary of Agriculture under date of September 29, 1927, the Board of Supervisors, on October 31, 1927, passed Resolutions Nos. 28,007 and 28,008 (new series), authorizing the conveyance to the United States of the following described lands in the Stanislaus National Forest and the Yosemite National Park.

Resolution 28,007—640 acres at the junction of Cherry and Eleanor Creeks in the Stanislaus National Forest adjacent to the west boundary of Yosemite National Park, requested by the Secretary of Agriculture by letter of September 29, 1927.

Resolution 28,008—1st—the 160 acre tract known as "Canyon Ranch" and, 2nd—the 120 acre tract in Tiltill Valley both situated within Yosemite National Park, both of these parcels as per request of the Secretary of Interior of July 7, 1927.

The Secretary of Agriculture requested also that the City convey to the United States the 328.78 acre tract at Mather Station, formerly designated as "Hog Ranch" lying in the Stanislaus National Forest about one-half mile south of the Yosemite National Park boundary. On this land is the City's saw mill, which is not at present in use, but will be required for future construction under the provisions of the Raker Act. Also on these lands are located the station building and quarters for the section crews of the City's Hetch Hetchy Railroad. Upon the request of the Secretary of the Interior, the tracks were temporarily removed on the easterly nine miles of this railroad between Mather Station and Hetch Hetchy, with the express understanding that when necessary for the City's future construction work, the tracks may be relaid. This will be necessary for the completion of the O'Shaughnessy Dam to its ultimate height, and for the construction of the contemplated high dam at Lake Eleanor.

In view of the above facts the Mather property is still "actually required for use" under the provisions of the Raker Act and the City therefore has not included it among the lands now being transferred to the United States, but has requested that the Secretary of Agriculture withdraw his request for the transfer of this property.

In compliance with the obligations of the Raker Act surveys of trails along the north side of Hetch Hetchy Reservoir to Tiltill Valley

and Lake Vernon were begun in November, 1927; a camp was established at Mather and 9.1 miles of alignment and profile levels were run from November 1st to December 1st when work was temporarily discontinued owing to inclement weather. This work was again undertaken on June 25, 1928, when a survey camp was established at Lake Vernon; using this camp as a basis the surveyors are now running survey for the trail which leaves the trail along the north side of Hetch Hetchy Valley near the outlet of Rancheria Creek and leads to Lake Vernon via Tiltill Valley. When this latter survey is completed, the camp will be moved to a point on Rancheria Creek near Hetch Hetchy Reservoir and the trail survey will be completed to the upper end of Hetch Hetchy Reservoir in the Grand Canyon of the Tuolumne.

Mather Recreation Camp

The swimming pool begun during the last fiscal year was completed in the Fall of 1927. Forces of the City Engineer also did miscellaneous work around the Camp for the Playground Commission, such as the installation of pipe lines, septic tanks, and sewage pumping station. This latter was put in service to divert the sewage from the Recreation Camp into the watershed of Middle Fork of Tuolumne River.

Automobile Tourist Camp

Construction of water and sewer systems at Mather was completed in August, 1927. The water is brought from Canyon Ranch in 2-in. and 4-in. pipe. Effluent from the sewage septic tank discharges into a disposal field located on the drainage basin of Middle Fork of Tuolumne River, which empties into the main river many miles below the aqueduct intake for San Francisco's water supply.

The tourist camp at Mather is laid out in the lower Hog Ranch Meadows, alongside the water pipe line from Canyon Ranch. Numerous tables and water hydrants have been provided. There are two comfort stations of the best approved type. These are wooden buildings on concrete floors and contain showers, lavatories and toilets. The entire camp is fenced and cattleguards are provided where the roads enter the camp. Entire cost of construction in 1927, including water supply, sewer system and camp facilities approximates \$50,000.

Hetch Hetchy Railroad

There has been no steam service on the railroad during the fiscal year. Occasional runs of gasoline motor cars have been sufficient for the needs of the work. Maintenance of telephone and power lines has been aided by the use of small gasoline "speeders."

Practically no track work is necessary but special care has been given to keeping culverts and ditches clear and road crossings in safe condition.

The equipment of the railroad remains as in the previous year.

Storage Reservoirs

At the storage reservoirs, Hetch Hetchy and Lake Eleanor, the same

operating force is maintained as in the last fiscal year. The dam tender at Lake Eleanor not only takes care of the operation of the valves and spillway in the outlet system, but also keeps hydrographic records which are used in conjunction with United States Weather Bureau reports. A small crew worked at favorable times removing logs from the reservoir. These are towed to the dam, floated over the spillway, split by blasting and burned. The dam tender at O'Shaughnessy Dam, assisted by one man, operates the outlet valves, protects and maintains the City's property and is responsible for the transportation of supplies and equipment to Lake Eleanor.

The tourists who visit Hetch Hetchy are instructed in the general features of the Hetch Hetchy problem by Mr. Shaw, the caretaker at Mather, who makes daily trips to Hetch Hetchy during the tourist season.

The road from Hetch Hetchy to Lake Eleanor was put in condition for transportation of supplies during April. This road by agreement with the National Park officials is closed to automobile traffic, except on official City or Park business, but is becoming exceedingly popular with hikers and horsemen visiting Lake Eleanor or the lakes popular for fishing in the vicinity of Jack Main Canyon and other favorite spots in the northerly part of Yosemite National Park.

On July 15, 1927, a bronze tablet placed upon O'Shaughnessy Dam in honor of Senator Key Pittman, who valiantly led the fight in the Senate to secure the Hetch Hetchy for San Francisco, was dedicated in the presence of City officials and other visitors. A similar tablet was dedicated June 17, 1928, in honor of former U. S. Senator James D. Phelan, our distinguished ex-mayor, who was serving in that capacity at the time of the original filings on water of Tuolumne River in 1901.

Aqueduct—Mountain Division

The Mountain Division Aqueduct, from Early Intake Diversion Dam to Priest Reservoir, has been in constant service, carrying the usual average flow, about 735 second feet, for the operation of Moccasin Power Plant. During the spring of 1927 the 9½ foot diameter pipe crossing the South Fork of Tuolumne River was slightly dented by rock which dropped with a fall of several hundred feet off the almost vertical cliffs of the canyon wall. At the same time, the stem and yoke were broken off the 12-inch blow off valve. Repairs were made in August, 1927.

Moccasin Division

During the year six new additional cottages and two garages for employes were built at Moccasin Power House. The permanent settlement now consists of twelve cottages, a clubhouse, three multiple stall garages and a schoolhouse. All the buildings have tinted concrete finish and tiled roofs and present a very attractive appearance.

The cottages have from four to six rooms each, all electrically

heated, and are equipped with electric ranges and water heaters. A moderate rental, sufficient to insure proper upkeep is charged.

Power System Operation

The two power plants of the Hetch Hetchy project at Moccasin and Early Intake have continued to function satisfactorily throughout the year.

Early Intake Plant Operation:

The Early Intake plant is located on the Tuolumne River a short distance below the dam which diverts the water released from the O'Shaughnessy Dam into the aqueduct leading to Priest Reservoir and the Moccasin Power House. The plant utilizes the waters of Cherry River supplemented by storage at Lake Eleanor. It is a small plant of 3000 kv-a rated capacity, constructed in 1917 to furnish power for construction purposes. During the war, under orders from the Power Administrator, arrangements were made to dispose of the surplus power to the Pacific Gas & Electric Company. Since the completion of the Mountain Division the plant furnishes electric energy used in the upper division of the project including O'Shaughnessy Dam, Mather Camp and Groveland, the surplus being disposed of to the Pacific Gas & Electric Company at a point near Moccasin Power House.

During the portion of the year when there is ample stream flow to operate both plants without drawing from storage, the Early Intake Power House is operated to full capacity, 3,300 kw.

During the late summer and autumn months, when the stream flow is low and stored water is being used, most of the water diverted from the Cherry River is carried past the Early Intake plant to a point just above the Tuolumne River diversion dam, thus making the water stored in Lake Eleanor available for the operation of the Moccasin Power House, and thereby decreasing the draft from storage in Hetch Hetchy Reservoir. The minimum output of the Intake plant during these months is in the neighborhood of 400 kw. The output is not uniform, because the Intake plant is used to regulate the height of the water at the diversion dam.

On account of the distance, approximately 12 miles, between O'Shaughnessy Dam and the point of diversion, from six to eight hours elapse between the release of water at O'Shaughnessy Dam and its arrival at Early Intake Diversion Dam. This makes it difficult to maintain the height of water in the small reservoir above the diversion dam at the desired elevation without spilling or wasting water. Also, the amount of water released through the valves at the O'Shaughnessy Dam has a tendency to vary according to the height of the water in the reservoir.

By varying the load carried by the Early Intake plant, the amount of water diverted from Lake Eleanor storage via Cherry River to Moccasin Power House can be controlled between zero and 125 cubic feet per



HETCH HETCHY TRANSMISSION LINE
Power line towers at crossing of
San Joaquin River

second. A distant indicating water level gage operated between the diversion dam and Early Intake Power House enables the operators to so regulate the load as to hold a given elevation of water in the reservoir at the diversion dam.

At the Early Intake Plant are the following employees,—1 chief operator in charge, 3 power house operators, 2 ditch tenders and 1 dam tender.

Moccasin Plant Operation:

Operation of the Moccasin Power House and its associated transmission line has been continued without any incidents of particular note. It is of interest, however, that one of the two transmission lines, connecting the power house with the Pacific Gas & Electric Company's Newark Substation has never, since the commencement of operation in August, 1925, had a power interruption occasioned by failure of any portion of the line or its equipment. The other line, known as No. 3 Line, has been struck by lightning on three occasions, resulting in momentary interruptions and necessitating the replacement of three strings of insulators.

During the year a considerable amount of work has been done around the transmission line towers in the way of grading to secure satisfactory drainage. This was not done at the time of construction, as the usual settlement was expected around the tower footings. This has now taken place, and the work done during the past year will not have to be done over again.

The men employed on power operation and maintenance of the Moccasin system are,—

At Moccasin Power House, 1 chief operator, 4 first operators, 3 second operators, 4 floor men, 3 governor men, 1 electrician, 1 mechanic, 1 to 2 helpers and 1 laborer.

At Riverbank, on transmission line patrol, 1 lineman and 1 helper.

At Livermore, on transmission line patrol, 1 lineman and 1 helper.

In 1927 draft from water stored in Hetch Hetchy Reservoir did not begin until the last week in July. A good stream flow into the reservoir continued until late in the summer, resulting in a relatively slow withdrawal of stored water. During the month of November the runoff from rainfall was almost sufficient to operate the system. However, from the last week in November until after the middle of March, practically all of the water used came from storage, resulting in the minimum elevation of Hetch Hetchy Reservoir being reached on the 19th of March, 1928, when the spring runoff commenced. The reservoir began to spill on May 19, 1928, and continued to spill until June 26, 1928.

The U. S. National Park Service estimates that the snowfall in the high Sierra for the season 1927-1928 was about 47 per cent of normal. About the same conditions existed at the Lake Eleanor weather observation station. The commencement of draft from Lake Eleanor in 1927 was August 1st; and in 1928, July 2nd. The early rains, beginning

October 27, 1927, almost filled the reservoir, and relatively good stream flow made it possible to hold this water.

From the above it can be seen that it was necessary this year to begin drawing from storage from Hetch Hetchy, approximately one month earlier than last year. With normal rainfall and runoff during the fall and winter, ample water is in storage for the season's operation.

Statistical data as to power output and disposition follow:

July 1, 1927, to June 30, 1928

Moccasin generated	526,468,000 kw hrs.
Early Intake generated	18,884,300 kw hrs.

TOTAL	545,352,300 kw hrs.
--------------------	----------------------------

Distribution of above Power:

Consigned to P G & E—Newark	475,826,400 kw hrs.
Used in City Work	12,755,850 kw hrs.
Used at power houses	1,002,160 kw hrs.
Delivered to P G & E—Tuolumne Ct., net.....	13,032,000 kw hrs.
Losses and unaccounted for	42,735,890 kw hrs.

TOTAL	545,352,300 kw hrs.
--------------------	----------------------------

The financial statement at the end of this report shows the detail of income and expense.

Transmission Line Bond Issue:

In the election of November 8, 1927, the Supervisors, without recommendation from this office, placed upon the ballot a proposed issue of \$2,000,000 worth of bonds to construct transmission lines from Newark to San Francisco, with a step down station. This proposition failed to secure the necessary two-thirds majority and was defeated by the following vote: Yes, 52,216; No, 50,727.

Aqueduct—Foothill Division

This division extending from Moccasin Creek to Oakdale Portal, includes the Moccasin Re-regulating Reservoir, with its two dams and conduit, the tunnels and the steel pipe interrupting the tunnel at Red Mountain Bar.

Hetch Hetchy Junction Shops:

Shops at Hetch Hetchy Junction have been operated during the year for repair and upkeep of plant and equipment as in the previous year. Minor repairs are made at the individual camps and the central shop handles major repairs.

Moccasin Re-Regulating Reservoir:

In the fall of 1927, clearing of the reservoir site was completed; that portion of the conduit which will by-pass the flow of Moccasin Creek at the Reservoir, was constructed where it crosses under the downstream dam. This conduit is of reinforced concrete 10 feet in diameter. The section built contains 446 cubic yards of concrete, inclusive of the portion of the core wall which is directly under the conduit, and of the

"Y" branch outlet. It will be later connected to the outlet gate when that structure is built. Test holes were dug in the axis of the upper dam of the re-regulating reservoir in May, 1928.

Tunnel Driving:

In driving the tunnel in this division, plans vary but little from those in the completed divisions of the tunnel. The same horseshoe section (sec. No. 1) 10 ft. 3 in. by 10 ft. 3 in. with arch radius 5 ft. 1½ in., wall radius 10 ft. 3 in. and bottom radius 15 ft. 4½ in., lined with a minimum thickness of 6 inches of concrete and of a neat area 87.94 sq. ft., was planned to be used where conditions indicated a heavy external pressure.

A modification of this section with vertical sidewalls below the spring line was called section No. 2. Neat area of cross section is 91.67 sq. ft. Unlined section No. 5 has an arch radius of 6 ft. 8 in., vertical sides, and invert radius of 20 ft. 5 in., with 18 in. radius fillets. Cross section is 166.5 sq. ft. and clear height 14 ft. 3 in. Grade of invert is 1.5 feet per thousand.

The general method of tunnel operation was to drive to standard section No. 5 (unlined) only where it was certain that hard solid rock would be encountered. In all other portions of the tunnel the concrete



HETCH HETCHY AQUEDUCT—FOOTHILL DIVISION
MOCCASIN RE-REGULATING RESERVOIR

Moccasin Creek by-pass conduit through downstream dam of reservoir.
Rock crushing plant and stock piles of rock for tunnel lining

lined standard section No. 2 would be used. After the completion of tunnels which had been driven to section No. 2, an inspection would be made to determine where, in these portions, the rock conditions were such as to warrant enlargement from the smaller lined section to the unlined rock section No. 5. In furtherance of this method, out of 80,605.8 feet of tunnel driven to date, 15,952 feet have been driven to unlined section No. 5, 64,203.8 feet to lined section No. 2 and 450 feet to a special section designed to take care of hydrostatic pressure which will be due to the water in the reservoir at Moccasin. Of the total length of tunnel driven to lined section No. 2, 24,918 feet or 38.8 per cent have been enlarged to unlined section No. 5 during the past year.

The total length of tunnel in the Foothill Division is 83,662 feet or 15.8 miles. As noted in the annual report for the preceding fiscal year, contracts covering 38,300 feet were let in October, 1926, the balance of the work being handled by the City on a day labor basis.

At **Moccasin Portal** 4,981 lineal feet of tunnel were driven during the year, giving an average monthly progress of 415 feet. At the beginning of the year, the driving was through Mariposa slate containing only an ordinary amount of water. Later, amphibolite schist was encountered, generally hard and standing without timber, but often showing shattered zones containing water bearing seams. Many of these were penetrated and the tunnel driving progress was greatly decreased on account of the special methods necessary to grout off these seams when they were encountered. During the year, 21 shut downs for this purpose were made, causing a total loss of 65 days of tunnel driving time. The maximum amount of water encountered in these seams was 700 gallons per minute under a pressure of 380 lbs. per square inch. In grouting off the seams 2344 sacks of cement were used. Of the 4981 feet of tunnel driven in this heading 1710 feet were driven to standard section No. 2 and 3271 feet to standard section No. 5. No timbering was necessary in these portions. The work at Moccasin was conducted by day labor forces under the direction of the City Engineer.

At **Brown Adit** the work was carried on by T. E. Connolly, under contract 113-E. There were no unusual difficulties to interfere with the work and good progress was maintained in advancing both east and west headings.

The east heading was driven through amphibolite schist interrupted by two belts of serpentine, 825 feet and 110 feet in width respectively. Little water was encountered at these belts or near them, but fourteen sets of timber were placed in one and five sets in the other.

Of the 4981 feet of tunnel driven in the east heading during the year, 4726 feet were driven to section No. 5 and 255 feet to section No. 2. Subsequently 105 feet of the 255 feet of section No. 2 were enlarged to section No. 5. Of the total footage of tunnel driven during the year 75 feet or 1.5 per cent has been timbered.

The west heading penetrated amphibolite schist with diorite near the portal at Red Mountain Bar. Until December 19, 1927, 1655 feet of tunnel were driven, when the heading holed through to the open cut at Red Mountain Bar; 142 feet or 8.5 per cent required timber. Of the total length of 6759 feet driven west from Brown Adit, 6031 feet were driven to lined section No. 2 and 728 feet to unlined Section No. 5, but subsequently 1190 feet of the smaller section were enlarged to the unlined section and this work is still in progress. A part time crew is used to carry on this enlarging, when they can be spared from work of the east heading.

At a point about 200 feet easterly from the east portal at Red Mountain Bar, there will be a concrete lined surge shaft. This surge shaft is designed primarily to function in connection with the regulation of the proposed power plant to be erected at Red Mountain Bar, but will also serve to limit pressure variation in the aqueduct. At this point the tunnel invert is at elevation 839 feet and the top of surge shaft will be approximately 930 feet. The upper part will be a cylindrical section of 35 feet clear diameter, with 18 inch concrete walls, with a lower conical portion immediately above the tunnel. The cone is 20 feet in diameter at the top and slopes into the tunnel from a depth of 10 feet. The chamber was excavated as a "glory hole." A raise 7 feet by 10 feet was used to remove the material from the main excavation down to the tunnel. Work was begun on December 20, 1927. A small crew was used whenever convenient and the excavation, which was 57 feet deep and involved 2715 cubic yards, was completed on May 30, 1928. Driving was discontinued in the west heading on February 6, 1928, to allow the force from Hetch Hetchy Junction east heading to hole through.

The aerial tramway spanning Pedro Reservoir and Red Mountain Bar and the tram line to Brown Adit were operated during the year by the contractor for the transportation of men, materials and supplies to Brown Adit Camp.

All work at **Pedro** was done by day labor forces under the direction of the City Engineer. As noted in the last annual report, the east heading was holed through to Red Mountain Bar in September, 1926. Total progress for a period from July 1st, 1927, to date of holing through was 4,330 feet or an average monthly progress of 591 feet. The tunnel was driven through a serpentinized schist and Mariposa slate and required a total of 433 lineal feet of timber or 7 per cent of the tunnel driven during the year. The maximum water pumped was 40 gallons per minute.

The total length of tunnel driven from this heading is 12,559 feet, all of which was driven to lined section No. 2. Subsequently 6,437 feet, or about 51 per cent, were enlarged to unlined section No. 5, the enlarging operations beginning on February 16, and being completed on May 28, 1928. Forces from Pedro Camp enlarged 4,682 feet of the tunnel and 1,755 feet were enlarged by forces from Hetch Hetchy Junction. The camp at Pedro was shut down June 30, 1928.

At **Hetch Hetchy Junction** work was carried on by City forces. In the east heading exceptionally good progress was maintained, 4,855 feet of tunnel being driven from July 1st, 1927, to February 11, 1928, when the tunnel holed through to the west heading from Pedro. During September the heading was advanced 803 feet, or 22 feet more than the record progress which was made in the month of March, 1927. This performance is all the more creditable in view of the fact that on Labor Day no work was performed. The average monthly progress was 667 feet. The rock encountered was Mariposa slate and some schist. All of this tunnel was driven originally to lined section No. 2, but during the period from February 15th to May 8th, 3,165 feet were enlarged to unlined section No. 5. Of the total distance of 10,902 feet driven eastward from Hetch Hetchy Junction, 1410 feet or 1.3 per cent have been enlarged to section No. 5. As above noted, 1,755 feet of Pedro west heading were enlarged by crews from Hetch Hetchy Junction. The west heading was advanced 2,274 feet from July 1st to November 20, 1927, at which point it holed through to the east heading from Rock River. Of this portion, 655 feet were driven to lined section No. 2 and 1,619 feet to unlined section No. 5. The average monthly progress was 487 feet through a formation of Mariposa schist and porphyrite. No timber was placed in this portion of the tunnel. After holing through, 4,639 feet of tunnel, or 72 per cent of the total of 6,450 feet driven west were enlarged from lined section No. 2 to unlined section No. 5.

At **Rock River** all work was handled by A. Guthrie & Co. who advanced the east heading 1625 feet from July 1st to November 15, 1928, when work was stopped to allow the crew from Hetch Hetchy Junction west heading to hole through. The rock penetrated was Mariposa schist, in which a few talc seams necessitate short sections of lining. No timber was placed. Of the 4,876 feet of section No. 2 driven, all but 50 feet have been enlarged to section No. 5, this work having been done between November 22, 1927, and April 1, 1928.

The west heading was driven 2092 feet to Section No. 2 through Mariposa schist and porphyrite until it was shut down on December 10, 1927, to allow the crew from Oakdale Portal to hole through. Between December 21, 1927, and April 27, 1928, permanent timber was placed in 564 lineal feet or 27 per cent of the 2092 feet driven. Of the total length of tunnel driven in the west heading, 3,865 feet or 57 per cent were enlarged from section No. 2 to section No. 5.

At **Oakdale Portal** 4,794.8 feet of tunnel were driven from July 1st, 1927, to April 12, 1928, on which date the tunnel holed through to Rock River. The rock encountered was Mariposa schist and porphyrite in which were found a number of talc and mud seams which occurred in zones of very hard solid rock. This tunnel was all driven to section No. 2. Timber was placed in 232 lineal feet or 4.6 per cent of tunnel driven. Tunnel enlarging operations were started on May 21, 1928, and will be completed in July. To date a total of 2,671 feet or 29.4 per cent of the

total length of tunnel in this heading has been enlarged from section No. 2 to Section No. 5.

Of the total of 83,622 feet of tunnel in the Foothill Division, 96 per cent or 80,606 feet have been driven, leaving still to be completed 3,016 feet in the section just west of Moccasin Creek. This is being attacked from Moccasin Portal and Brown Adit and it is expected that it will be completed shortly.

A summary of tunnel driving progress is shown in the following tabulation:

Hetch Hetchy Aqueduct—Foothill Division

Progress of Tunnel Excavation

	Distance Driven during 1927-28		Total Driven to June 30, '28		Distance Between Working Points
	Lineal Feet East	Lineal Feet West	Lineal Feet East	Lineal Feet West	
Moccasin Portal:					
City Forces		4981	.....	7175	
Brown Adit:					21,110 [†]
City Forces			879	903	
Contract Work	6022	1655	10040	5856	
TOTAL			10919	6759	6,759
Red Mountain East Portal (Not a working point)					
Red Mountain West Portal (Not a working point)					
Pedro Adit: City Forces.....		4330*	1179*	12575*	1,179
Hetch Hetchy Junction					23,477
Shaft: City Forces.....	4885	2274	10902	8069	15,281
Rock River Shaft:					
City Forces			1711	1334	
Contract Work	1625	2092	5501	5445	
TOTAL			7212	6779	15,857
Oakdale Portal: Contract.....	4795		9078		
Totals, City Forces		16,470		44,727	
Totals, Contract Work		16,189		35,920	
Totals in ft. City & Contract....		32,659		80,647	83,663
Totals in miles		6.18		15.27	15.85

[†]Tunnel still remaining to be driven 3016 ft. or 0.57 mile.

*Figure for east includes 25 feet actually in open cut east of center line of adit. Figure for west includes 16 ft. in open cut west of center line of adit. The adit itself is really an open cut approach.

The following tabulation shows the length of tunnel timbered and percentage timbered of the length of tunnel excavated to June 30, 1928:

Hetch Hetchy Aqueduct—Foothill Division

Length of Tunnel Timbered

(from commencement of construction)

Percentages shown in the last two columns below are based on total progress to June 30, 1927, as shown in table above.

	Timbered Tunnel			
	Lineal Feet		Per Cent Timbered	
	East	West	East	West
Moccasin Portal		1306	.....	18.2
Brown Adit	327	425	3.0	6.3
Pedro Adit	1117	1270	96.8	8.0
Hetch Hetchy Junction Shaft.....	2662	115	24.4	1.4
Rock River Shaft	20	924	0.3	13.7
Oakdale Portal	707	.....	7.8	.....
Totals.....	8873 ft. (1.68 miles) or 10.9%			

The following tabulation shows the lengths of tunnel of the various sections as of June 30, 1928:

Hetch Hetchy Aqueduct—Foothill Division

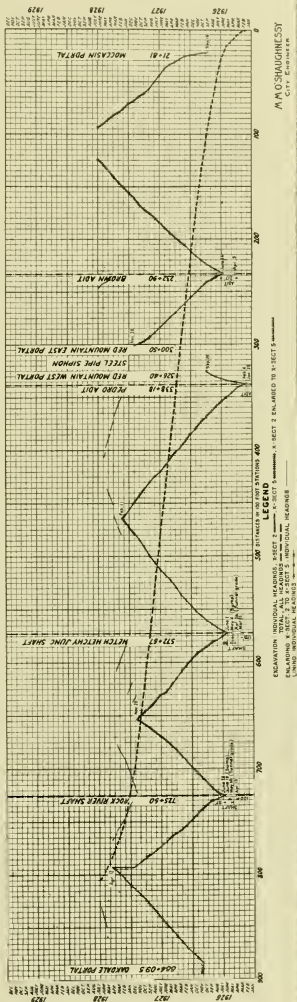
Lengths of Tunnel of Various Sections

	Lineal Feet	Miles
Tunnel driven to Section No. 2.....	64,204	
Tunnel enlarged from Section No. 2 to Section No. 5	24,918	
Remainder of Section No. 2.....	39,286	7.4
Tunnel Driven to Section No. 5.....	15,952	
Tunnel enlarged to Section No. 5.....	24,918	
Total of Section No. 5.....	40,870	7.7
Special Section at Moccasin Portal.....	450	.1
TOTAL to date	80,606	15.2

Tunnel Lining from Hetch Hetchy Junction:

In November, 1927, construction and assembling of a concrete plant at Hetch Hetchy Junction was begun. This plant is practically complete. From this point all tunnel lining will be placed from Red Mountain Bar on the Tuolumne River to a point between Hetch Hetchy Junction and Rock River, a distance of approximately 6.2 miles. Owing to the unsatisfactory character of material immediately available as well as economical considerations, all aggregate required for concrete will be purchased. Delivery will be via the Sierra Railway to Hetch Hetchy Junction where a spur track will lead directly to the shaft. This spur track, which was

HETCH HETCHY AQUEDUCT - FOOTHILL DIVISION TUNNEL PROGRESS CHART



completed recently, has capacity for ten cars with a siding for empties and spur tracks to the cement house and over a dump trestle. The greater part of the plant equipment which was used for lining the Mountain Division tunnels is being installed in this plant. This machinery has been entirely overhauled and some parts were extensively remodeled. As part of the concrete plant, there have been built a cement shed for storing cement, a dump trestle for dumping and storing aggregate and a belt conveyor for transporting aggregate to the shaft. It is expected that concrete lining operations will begin in July, 1928.

Tunnel Lining from Rock River:

At Rock River shaft, the tunnel contractor has completed a concrete plant for lining tunnel driven under his contract. Crushed rock for concrete aggregate is being obtained from screening the spoil hoisted from the tunnel and from a small crushing plant which is being operated under a sub-contract. A portion of the sand is being obtained from screening the tunnel dump, while the remainder is purchased from a sand and gravel plant in Oakdale. This material is hauled to Rock River by motor trucks operating over the State highway. The contractor is now contemplating the construction of a sand and gravel plant in the Stanislaus River at a shorter distance from the shaft than the present plant.

Experiments have been made in placing concrete from this shaft, but actual lining will probably not begin until August, 1928. This plant will handle lining operations over a distance of three miles.

Tunnel Lining from Moccasin Portal:

At Moccasin Creek a rock crushing plant was completed in the early part of the fiscal year and put in operation in September, 1927. This plant will provide crushed rock and sand for concrete for not only the tunnel from Moccasin Portal to Red Mountain Bar, a distance of 5.3 miles, but also for the structures appurtenant to the Moccasin Regulating Reservoir and for the tunnel intake tower at Moccasin Portal. During the year this plant produced 25,843 cubic yards of crushed rock and 14,128 cubic yards of sand. Tunnel lining operations will not be begun at Moccasin Portal until the tunnel holes through between Moccasin and Brown Adit.

Aqueduct—Coast Range Division

At the beginning of the year, work was just getting under way in this division. Shaft sinking had begun at Mocho and camp buildings were being erected at Valle. During the year roads have been built to all camps, power and telephone lines completed, water supply provided, camps built, 2,245 feet of shaft sunk, portions of the shafts lined with concrete, and work was begun on crosscuts from shafts to main tunnel line.

Tunnel driving will be carried on from four portals and five shafts,

giving a total of fourteen headings. Distances between working points as indicated from preliminary surveys are as follows:

	Full Depth of Shaft Feet	Tunnel Miles	Pipe Miles	Distance from Tesla Portal Miles	Irvington Portal Miles
Tesla Portal				0.	29.14
Thomas Shaft	351	4.46		4.46	24.68
Mitchell Shaft	804	4.20		8.66	20.48
Mocho Shaft	818	5.22		13.88	15.26
Valle Shaft	570	2.90		16.78	12.36
Indian Creek Shaft.....	304	5.09		21.87	7.27
East Alameda Portal		3.25		25.12	4.02
West Alameda Portal.....			0.58	25.70	3.44
Irvington Portal		3.44		29.14	0.
TOTAL		28.56	0.58		

Livermore Headquarters:

Livermore was selected as headquarters for the Coast Range Division because it lies approximately midway on the work and is served by both the Southern Pacific and Western Pacific Railroads, and it is a convenient central point reached by roads radiating to the various shaft points. Buildings, yards, etc., are located on a six-acre tract of land leased from the Southern Pacific Company. On this lot are located a material yard for storage and supplies and a wood working yard in which timbers for shaft construction are framed ready for use in the shafts. The head frames of the shafts were framed in this yard. A pipe dipping plant is in operation, dipping and repairing all water pipe and ventilating pipe as it is transferred from the Foothill Division to the Coast Division. A warehouse 40 x 120 feet, with 8-foot platform on all sides, has been built with wooden frames and galvanized steel covering. Pending the construction of an office building for which space has been assigned, temporary office space is provided in the warehouse. A galvanized steel garage to house six trucks has been completed.

The warehouse was built from December 1, 1927, to January 21, 1928. Plans have been completed for a machine shop on which construction will start in the near future and machinery is now being purchased. The shop is designed to handle repair work on all equipment used in the division. The warehouse is reached by a spur track 1,640 feet long built in December, 1927.

Surveys:

Parties are now engaged in checking the final precise surveys for alignment, distance and levels between the various working faces of the

division. Land surveys have been made of the various properties to be acquired. Location has been made for roads, camp sites and portals. Alignment of shafts is checked continuously as the sinking progresses.

All springs in the vicinity of the tunnel have been located and measurements of their flow have been taken throughout the year.

Right-of-Way Acquisitions:

Out of a total distance of 29.2 miles of aqueduct from Tesla Portal to Irvington Portal, 27.9 miles of rights of way have been acquired. This figure includes 7.4 miles of aqueduct through property of the Spring Valley Water Company which will be taken over by the City upon the acquisition of the Company's properties within the next few months.

The rights of way for the remaining distance of 1.3 miles will probably have to be acquired by court action. A condemnation suit has been filed covering land and right of way on the west bank of Alameda Creek required for aqueduct pipe lines and a dump area for the tunnel to be constructed from West Alameda Portal. This suit also covers part of the land required for the Irvington Portal site, the remainder having been purchased without condemnation. Another condemnation suit is being prepared for the acquisition of about a mile of right of way midway between Alameda Creek and Irvington Portal.

Roads:

The seven camps at which work is in progress are now accessible by surfaced roads of a fair type of construction. Roads to some of the camp sites did exist but they were narrow, crooked and on grades not satisfactory for motor-truck haul. In some cases there were no roads.

Road work was begun in May, 1927, and continued to February, 1928. The first road completed was a one mile branch in heavy rock work, from the Mines Road to Mocho Shaft. Grading was completed June 30, 1927, and the road was surfaced with gravel in January, 1928.

Tesla Road, a county road extending from the Livermore Valley to Corral Hollow was regraded for a distance of six miles during April, May and June, 1927. Drainage was provided by construction of side ditches and installation of culverts and subsequently Alameda County surfaced the road with gravel.

A branch road, two miles long was built from the Corral Hollow Road to Thomas Camp. This was light work and was done by teams and scrapers.

A new road, two miles in length, was built from the Corral Hollow road up Mitchell Ravine to Mitchell Shaft. In this work 57,000 cu. yds. of earth and rock were excavated. The road is surfaced with gravel and with rock from the shaft. An Erie gas-air, one-yard shovel was used very successfully on this work.

From Mitchell road to Moy Station, which is the present end of spur track of the Western Pacific Railroad, the old Corral Hollow railroad grade has been widened and smoothed into a good, serviceable truck

road for a distance of six miles. On this work a heavy grader with sixty horsepower tractor was used.

Valle Shaft is reached from Livermore by a concrete highway ending in dirt road. Six miles of this latter road was reconstructed and regraded. Ditches were dug, culverts installed, and a gravel surface applied.

A new road was necessary for access to Indian Creek Shaft from the road leading to Calaveras Dam from Sunol. This road, five miles long, was graded, culverts set, timber bridges built and gravel surface applied.

Camp Water Supplies:

Considerable difficulty was encountered in securing water supply for camp and construction purposes, as the country traversed by the aqueduct is very dry for at least six months of the year.

Water for Thomas and Mitchell Shafts was obtained from the sub-surface supply in Corral Hollow. There is no surface flow in this creek for about eight months of the year, but by sinking three wells in the gravel a fair quantity of water was secured. This is forced by a motor driven pump through three miles of 3-inch pipe to Thomas Camp and five miles of 3-inch pipe to Mitchell Camp. This water has a high mineral content. At Thomas Camp, additional water is secured by pumping from the shaft. Water for drinking and for kitchen use at Mitchell Shaft is brought from Laurel Spring through a 1½-in. pipe line three-fourths of a mile in length.

Mocho Camp is supplied from a spring 2000 feet from camp and a nearby well dug in the bed of Arroyo Mocho.

Valle Camp receives 8000 gallons per day through four miles of 2-inch pipe from Leal Spring. This water is excellent in quality, but inadequate in quantity. Negotiations are under way to secure the use of an additional spring in this vicinity.

Near Indian Creek Camp, a spring on property of the Spring Valley Water Company yields 3,000 gallons daily of water of very good quality.

The two portals at Alameda Creek will be supplied by pumping from the creek, which always carries a large flow of water released from Calaveras Reservoir.

Irvington Portal will necessarily secure water from the 44-inch Spring Valley pipe line which leads from Niles Reservoir to a connection with the City's Bay Crossing Pipe line near Irvington.

Power for Construction Purposes:

The construction of 28.6 miles of tunnel demands a reliable power supply of considerable magnitude, as the greater part of tunnel driving is being done from shafts, and any interruption of power supply might, where water is encountered, result in flooding the workings. Two plans presented themselves for securing a power supply, one, to purchase energy from the Pacific Gas & Electric Company whose lines approach

the work at several different points, the other, for the City to build its own transmission line along the length of the aqueduct and secure the necessary energy by tapping the high voltage transmission lines connecting the Moccasin Power House and the Newark Substation of the Pacific Gas & Electric Company. Careful estimates were made as to power consumption and the cost of the electrical work which would have to be done by the City, also a definite proposal for furnishing energy was secured from the Pacific Gas & Electric Company. A comparison of the ultimate cost of the power from the two sources indicated that the most economical program was for the City to build its own line and use its own power.

Seco Substation:

Studies made to determine the best location for a substation resulted in the selection of a site approximately 9 miles southeast of Livermore where the high voltage transmission lines cross the Tesla county road. A 2.8 acre tract of land, adjacent to the transmission right of way, was purchased and plans were prepared for a substation having a capacity of 6,000 kw. This station is called "Seco Substation," taking its name from the location in the Arroyo Seco.

The design of the station provides for taking power from either of the two high voltage transmission circuits, the voltage on these lines at



HETCH HETCHY AQUEDUCT—COAST RANGE DIVISION
Seco Substation

this point being approximately 102,000 volts, when delivering to the Pacific Gas & Electric Company at 100,000 volts. The distance to Newark is approximately 22½ miles and to Moccasin 76 miles. The transmission lines may later be operated at a higher voltage so the equipment purchased is designed to be usable either at the present voltage or at the proposed higher potential. Twenty-two thousand volts was determined as the most satisfactory voltage for transmission along the aqueduct. This is the same voltage as has been used on the Mountain and Foothill Divisions with excellent results. By using the same voltage it will be possible to use any equipment which can be released from the upper end of the work.

The two tap connections from the high voltage lines pass through hand operated oil circuit breakers which may be isolated, with gang operated disconnecting switches. These two circuits come together on a high voltage bus supplying energy to a bank of three 2,000 kw., single phase transformers. A fourth transformer is provided as a spare. The low voltage or 22,000 volt side of the transformer is connected to a three-phase delta bus off which two feeder circuits are taken through disconnecting switches and oil circuit breakers.

The 22,000 volt feeder switches are of the reclosing type, it being planned that they will automatically restore service after a predetermined interval following an interruption caused by short circuits or overloads.

All of the buses and switches are supported from steel frame work, while transformers and oil circuit breakers are mounted upon concrete foundations. The control board and its auxiliaries are housed in a 14-ft. by 18-ft. building having a wood frame, sheathed with asbestos protected metal.

The high voltage oil switches are of the Brown Boveri make; the low voltage oil switches were furnished by the Condit Company. Transformers both at substations and along the transmission line at the camps were furnished by Allis Chalmers Company. The disconnecting switches were furnished by the Champion Company and the steel structure by Pacific Coast Steel Company.

One operator and maintenance man is located at this station.

The grounds were graded and road built to the main county road, using the gas-air shovel. Concrete foundations and a 4-room operator's house and relief man's quarters were completed in October, 1927. Transformers weighing approximately 30 tons were hauled by truck from Livermore yard to Seco. The plant was completed, tested and ready for service November 20, 1927.

Transmission Lines:

Construction of thirty miles of transmission line consisting of two 3-phase 22 kv. lines of No. 2 and No. 4 seven strand copper wire on cedar poles, has been completed during the year. The east line follows

the high voltage transmission line to Corral Hollow whence it takes a separate route to join the aqueduct line at Mitchell Shaft from which point it continues eastward to Tesla Portal paralleling the aqueduct right of way. The Corral Hollow pumps are operated through a branch line three miles long fed from the main through line at Thomas Shaft.

The west line extends from Seco Substation southwesterly to Mocho Shaft, thence westerly along the aqueduct line to Valle Shaft, Indian Creek Shaft and Alameda Portals. An extension will be made from Alameda Portals to Irvington Portal along the tunnel right of way as soon as the necessary easement is secured.

On account of the proximity to the Bay and fog conditions, the insulators (supplied by the Westinghouse Company) are designed for satisfactory operation under a potential of 45,000 volts under normal conditions. The No. 2 conductor extends from Seco Substation to Mocho Camp on the westerly circuit, the remaining parts of the transmission are of No. 4 conductor. Timber is cut from the right of way for a distance of 50 feet each side of the transmission line and brush is cleared for a width of 20 feet to permit moving poles and stringing wire; delivery of poles and other materials was difficult as the lines pass over several high ranges of rugged hills. Transmission line erection began July 5, 1927, and the lines were put in service December 12, 1927.

Camp Substations:

Substations have been built at Thomas, Mitchell, Mocho, Valle and Indian Creek Shafts, and the Portal stations will soon be so equipped. At shaft camps the installed capacity of power transformers is 600 kv-a and at portal camps 300 kv-a; each camp has one 15 kv-a lighting transformer. The transformers step down the power to 3-phase, 440-volt power current and 110-220 volt lighting current. All camps, buildings and underground workings are lighted by electricity, and electricity is used for firing the blasts in shafts and tunnels.

Telephone System:

Telephone communication between the various camps and the headquarters at Livermore is provided through two metallic circuits 39 miles in length, running from the central switchboard in the Livermore office. The circuits are in leased cables of the Pacific Telephone and Telegraph Company, as far as the outskirts of the town; from this point two open wire circuits on the power poles of the Pacific Gas & Electric Company extend for approximately 6 miles along the county road to Seco Substation. At the substation the two circuits branch, one going east and one west following the line of the 22,000 volt transmission circuit to the various camps. A branch telephone line three miles in length extends from Thomas Camp to Corral Hollow wells and gravel pit. The lines are of No. 9 E. B. B. galvanized iron wire on wooden poles. On account of the lack of habitations and improvements in the larger portion of the country through which both the transmission and telephone lines pass, it

was possible to use reasonably short, and therefore less expensive poles than would have been necessary in the more highly cultivated area.

Tunnel Construction:

The easterly end of the Coast Range Tunnel is at **Tesla Portal**, on the westerly edge of the San Joaquin Valley and distant seven miles south of Tracy. On October 29, 1927, upon the completion of grading on the Corral Hollow Road, the gas-air shovel was moved to this camp and used to grade the camp site preparatory to erection of buildings. The portal cut 270 feet in length and of a maximum depth of 45 feet was completed to the tunnel face. The operation involved the movement of 10,150 cu. yds. of material.

On May 28, 1928, work was started on erection of camp buildings. To date there have been completed one combined dining room and kitchen, one combined office and warehouse, seven 5-man bunk houses, and one bath house. Concrete foundations for motor operated compressor and blower have been completed and this equipment has been delivered at the site.

At **Thomas Shaft** grading of the camp site began September 15, 1927, together with construction of camp buildings consisting of dining room and kitchen, warehouse and office, seventeen 5-man bunkhouses, bath house, hoist and compressor house, blacksmith shop, and buildings for blower, caps, primers, and powder.

On October 15, a crew of eight men began sinking the shaft which was carried to a depth of 104 feet on December 24th when sinking operations were suspended. The shaft was then lined with concrete, which operation was completed on January 28, 1928. Permanent head frame was erected, electric substation built, and motor driven hoist, compressor and blower installed. The water supply already mentioned was connected to a 15,000 gallon tank and a cooling tower was erected.

Shaft sinking, resumed on April 9th, was carried to full depth of 351 feet on June 2, 1928. Tunnel station, skip-tender station, rock pocket and sump were then excavated and are now ready for concrete lining.

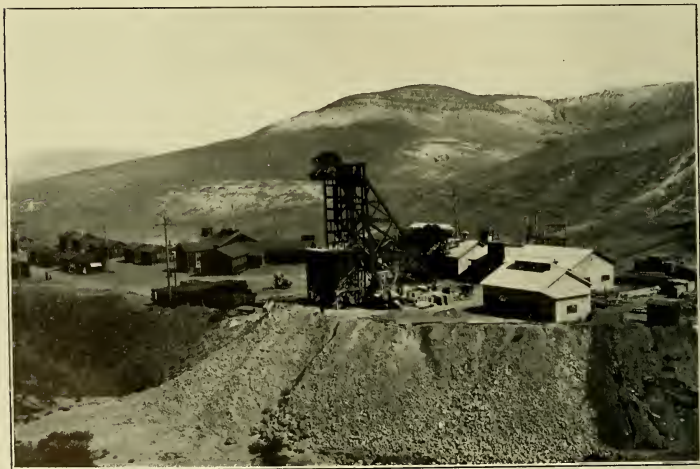
The shaft was sunk through soft sandstone carrying a small amount of water which was handled by air-driven sinker pumps. Timber was placed as the sinking progressed and removed as the concrete lining was placed.

Crew consisted of one foreman and twenty-five men, who carried on work continuously. During the month of May, 140 feet of shaft was sunk.

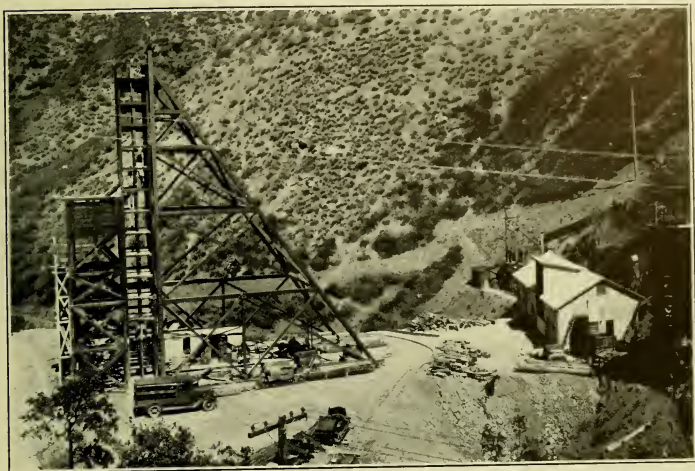
Commencement of work at **Mitchell Shaft** was delayed on account of difficulty in securing right of way. It was necessary to resort to condemnation proceedings to acquire title to the lands on which the camp and shaft are situated. The road work, which has been already described, was very heavy on account of the steep canyon walls. A temporary bridge was built across the ravine.



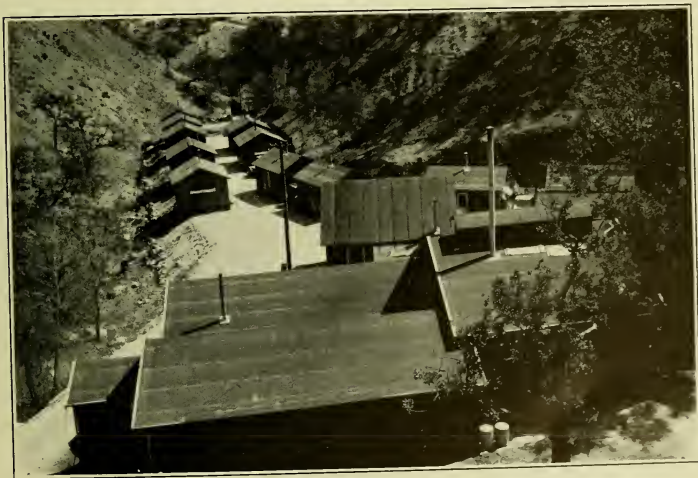
TESLA PORTAL
Beginning of 25 mile continuous tunnel



THOMAS SHAFT—Construction Shaft 351 ft. deep
HETCH HETCHY AQUEDUCT, COAST RANGE TUNNELS



MITCHELL SHAFT
Construction shaft 804 ft. deep



MITCHELL SHAFT CAMP
HETCH HETCHY AQUEDUCT, COAST RANGE TUNNELS

Camp building construction was begun September 16, 1927. The camp consists of a combined dining room and kitchen, combined warehouse and office, thirteen 5-man bunkhouses, two bath-houses, hoist and compressor house, blacksmith shop and houses for powder, caps and primers. Water from the Corral Hollow wells is received in a 50,000 gallon tank on the hillside above camp. The usual cooling tower was erected.

The shaft was sunk 20 feet and lined with concrete during September, 1928, thus permitting erection of a 77-foot head frame. A gasoline driven hoist and gasoline driven compressor were then installed and shaft sinking was resumed, using this temporary equipment, on November 23, 1928.

A power and lighting substation was erected but owing to slow delivery of electric motors, a long delay ensued before the motor driven hoist, compressor and blower were installed. On March 10, 1928, the temporary gasoline driven machinery was replaced by permanent equipment.

The shaft is in hard schist, badly shattered and cut by numerous seams of quartz and gouge. In the first 150 feet of depth water was encountered, requiring grouting to cut off the flow before proceeding with the sinking, but this flow diminished as the shaft gained depth. At a depth of 425 feet a concrete ring was built around the shaft to collect the water and lead it to a small reservoir from which it was pumped to the surface by a motor-operated double acting plunger pump set in a concrete lined station. Water encountered in sinking was lifted by air-operated sinker pumps to the same reservoir.

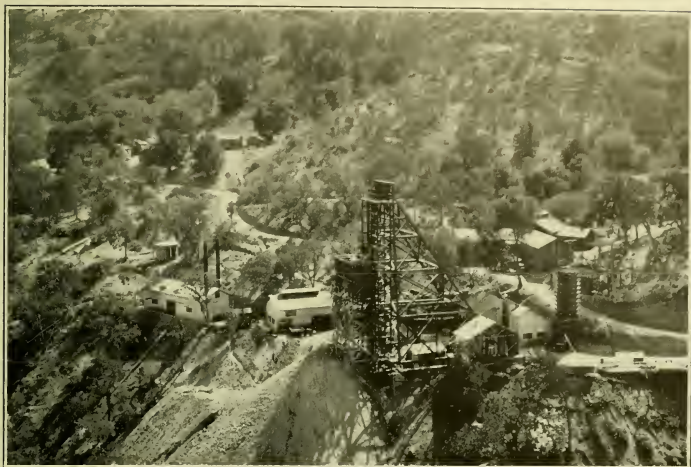
After passing the 150 foot level, good progress was made. Some difficulty was experienced on account of the presence of sulphuretted hydrogen gas and sulphur water, but the unpleasant odors have since been removed by the efficient ventilating system.

On reaching a depth of 475 feet, swelling ground in the vicinity of the pump station required the placing of reinforced concrete lining in 45 feet of the shaft. Since the concrete was placed no evidence of swelling has been noted.

On June 30, 1928, the depth of shaft was 524 feet. The greatest progress for one month was 96 feet. Unless unforeseen difficulties are encountered, the full depth of 804 feet should be reached in October.

The crew has consisted of one superintendent, one timekeeper, one blacksmith with helper, three shifters, eighteen miners, three hoistmen and three topmen. Work is carried on continuously using three 8-hour shifts.

At **Mocho Shaft** a small start was made during the preceding fiscal year, when the shaft was sunk 35 feet. During the present fiscal year the camp was enlarged by the building of nine bunkhouses, steam compressor house, electric compressor and hoist house and houses for oil, powder, caps and primers.



MOCHO SHAFT AND CAMP
Construction Shaft 818 ft. deep



INDIAN CREEK SHAFT AND CAMP
Construction Shaft 305 ft. deep
HETCH HETCHY AQUEDUCT, COAST RANGE TUNNELS

The steam compressor plant was installed to be used as a standby in event of electrical trouble, but it was in regular service until the electrical equipment was available on December 12, 1927. Hoisting is done by an electrically driven two drum hoist to a heavy head frame 77 feet in height. The hoist as well as the electrically driven compressor and fan were placed in operation February 15, 1928, and used for sinking the lower portion of the shaft.

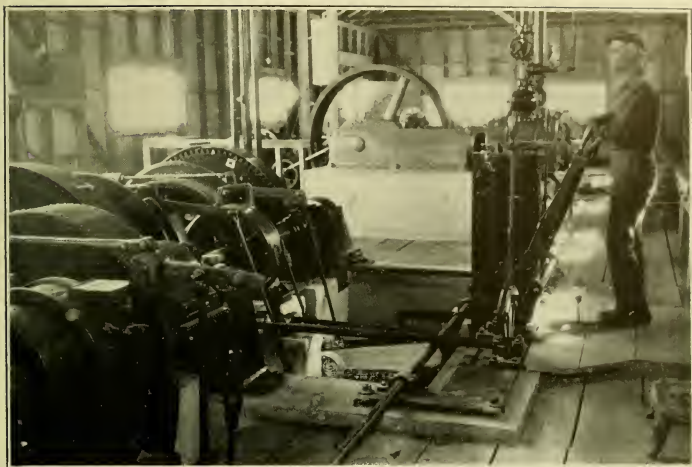
The rock encountered is hard schist in blocky formation, carrying considerable water and small amounts of gas. The shaft is timbered throughout with 8" x 8" or 10" x 10" timbers with continuous lagging. At the depth of 460 feet where the ground was particularly heavy, the timbers showed evidence of crushing so that it was necessary to line 44 feet of shaft with reinforced concrete lining. A pump sump was excavated at a depth of 455 feet, from which an electrically driven pump raises the water to the surface. All other pumping was done by air operated sinking pumps.

The shaft was completed to its full depth of 818 feet on May 31, 1928. A skip tender station 20 feet long by 10 feet high and 7 feet deep was excavated near the bottom of the shaft. The work was done by a crew consisting of one superintendent, one timekeeper, one blacksmith with helper, three shifters, 18 miners, three pump men, three topmen and three hoistmen, working in 8-hour shifts.

Valle Shaft is located on the bank of Arroyo del Valle about 9 miles south of Livermore. Construction of camp buildings was begun on July 9, 1927, and on September 8 the camp was opened for use of crew on construction of power transmission line. Since then additional buildings have been erected and the camp now consists of one combined kitchen and dining room, combined office and warehouse, hoist and compressor house, blacksmith shop, blower house, fourteen 5-man bunkhouses, bath-house, two-car garage, and houses for powder, caps and primers.

Shaft excavation was begun in September, 1927, using portable equipment. The shaft was sunk to a depth of 25 feet and lined with concrete by October 8th. A 57-foot head frame was then erected and power substation built, but on account of delayed delivery of electric motors, the permanent hoisting outfit was not ready for use until April 9, 1928. The usual two-drum hoist, compressor and blower, electrically operated, were installed. Shaft sinking was immediately resumed and at the end of the fiscal year, has been carried to a depth of 248 feet, with reasonable certainty of completion to the full depth of 370 feet during August, 1928.

The shaft is in fairly soft, blocky sandstone and showed but little water in the first 100 feet. At that depth the shaft penetrated rock with open seams carrying a large flow of water which necessitated grouting before sinking could be resumed. Below that depth grouting has been utilized continuously. Seven 2-inch pilot holes drilled to a depth of 36



Hoist and compressor

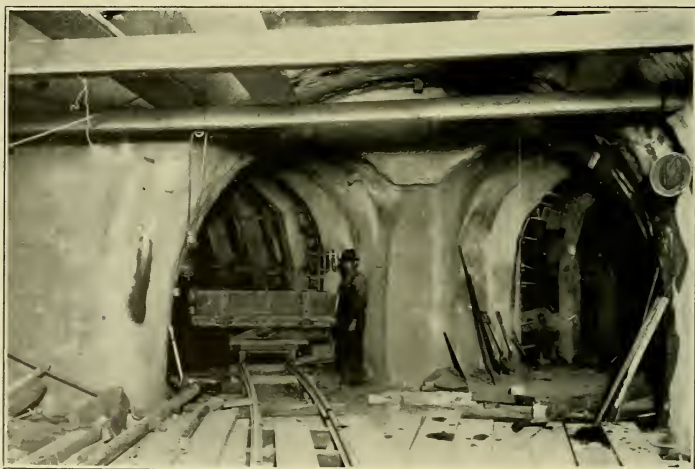


Crosscut at Shaft

HETCH HETCHY AQUEDUCT, COAST RANGE DIVISION—INDIAN CREEK SHAFT



Crosscut south for future tunnel construction



Crosscut north and beginning of tunnel construction

HETCH HETCHY AQUEDUCT, COAST RANGE DIVISION—INDIAN CREEK SHAFT

feet below the bottom of shaft are filled to refusal under 100 lbs. air pressure, with cement grout, thus shutting off what would have been large flows of water. The grouting slows the sinking progress considerably.

The shaft is timbered throughout with 8 in. x 8 in. timber sets and solid lagging.

Crew consists of one foreman, one timekeeper, three shifters, eighteen miners, three topmen, three hoistmen and one repair man.

Camp construction at **Indian Creek Shaft** was begun July 16, 1927, on the usual layout consisting of dining room and kitchen, office and warehouse, fourteen 5-man bunkhouses, bath house, hoist and compressor house, blower house, blacksmith shop, houses for powder, caps and primers and a 15,000 gallon water tank.

Shaft sinking, begun on October 15, 1927, was carried to a depth of 30 feet using temporary equipment and head frame to avoid injury to permanent head frame by blasting. Concrete lining was then placed and a 57-foot permanent head frame erected. Power and lighting substation was built, a Braun cooling tower erected and electrically operated two-drum hoist, compressor and blower installed.

Sinking was resumed on February 13, 1928, and completed to the full depth of 304 feet on July 21, 1928. A portion of the cross-cut at tunnel grade has been driven and lined with concrete.

Reinforced gunite lining applied to the entire shaft, following closely behind the excavation, has precluded any necessity for use of timber. The ground encountered is gravel imbedded in firm clay. On exposure to air this slacks and swells so that timber cannot be considered safe to hold the ground for any considerable length of time.

No difficulty was encountered with water and a small flow of gas was easily taken care of with the blower.

The shaft crew consists of three shifts, each of nine men. Two of these shifts work on excavation, the other on placing of reinforcing steel and gunite. The best progress for one month was 98 feet of excavation and 130 of lining.

Alameda East Portal is situated on the right bank of Alameda Creek about three miles south of Sunol. Here the aqueduct emerges from the hills, to cross the valley as 3000 feet of steel pipe line. On the left bank will be Alameda West Portal. It is planned to handle the work in both headings from one camp. During the year one combination kitchen and dining room, six 5-man bunk houses and one bath-house have been erected.

The open cut at Alameda East Portal has a length of 180 feet and runs to a height of 59 feet. The excavation of 5,330 cu. yds. was made between May 22 and June 30, 1928, by the Erie gas-air shovel.

No work has been done yet at Alameda West Portal nor at Irvington Portal.

Bay Development and Peninsular Reservoirs

The Bay Development, including Pulgas Tunnel and the completed portion of the Bay Crossing Pipe Line, has been in constant use by Spring Valley Water Company under lease from the City.

Owing to the lighter rainfall and consequent smaller run-off for the season the pipe line has carried a smaller amount of water from Niles Reservoir to Crystal Springs Reservoir than in the preceding year.

The average daily delivery for the year was 23.6 million gallons, as against 32 million gallons for the previous year; the maximum was 33.6 million gallons daily during October, 1927, while the minimum, in March, 1928, was 5.5 million gallons daily. Total storage at the end of the year, in the Peninsular Reservoirs and in the whole system, showed but little change from the previous year as will be noted in the following tabulation:

Water Stored in Spring Valley Reservoirs

Reservoirs	Capacities	Water in Storage		Storage
		6/30/27	6/30/28	6/30/28 as
		(Millions of Gallons)		% of Capacity
Peninsular System:				
Crystal Springs	22,512	12,168	14,212	63
San Andres	6,230	3,021	3,107	50
Pilarcitos	1,031	965	696	67
Total Peninsular	29,773	16,154	18,015	60
Alameda System:				
Calaveras	32,780	9,722	7,694	23
Total Peninsular and Alameda..	62,553	25,876	25,709	41

City Reservoirs:

During the year two small acquisitions of land in Glen Park Reservoir site were effected, one the purchase of a lot of 0.5 acres, the other a transfer of lands by which the City increased its holdings by .29 acres.

The Spring Valley Purchase

The citizens of San Francisco are to be congratulated on at last having voted the necessary bonds to acquire the system of the Spring Valley Water Company. On May 1st, 1928, a bond issue of \$41,000,000 was carried by a vote of 4 to 1, settling a question that has been under consideration and intermittent negotiation since 1871. In 1875 the Company offered its works to the City for \$15,500,000 but the offer was rejected as being excessive. In 1878 the City's Water Commission made a counter offer of \$11,000,000 which was refused. On January 14, 1910, in the same election in which the \$45,000,000 bond issue was authorized for Hetch Hetchy work, a proposition to purchase the Spring Valley

System for \$35,000,000 was defeated by the vote: For, 22,068; against, 11,722, a two-thirds vote being required. In April, 1915, a proposition to purchase for \$35,000,000 again failed to carry. Efforts in 1921 at a price of \$38,000,000 and in 1927 for \$40,000,000 were also unsuccessful. In these elections, as well as in the earlier ones, the proposition carried a substantial majority of votes, but failed to get the necessary two-thirds.

The recent campaign for the purchase of the Spring Valley system, which resulted in a decisive victory for the bonds by a vote of 82,490 to 21,175 was very effectively conducted. The press of San Francisco was solidly behind the purchase which was likewise endorsed by practically every civic organization.

The campaign was essentially one of education, no small part of which was borne by members of the engineering department. Motion pictures showing the physical features of the Water Company's system, taken by our staff photographer were shown in most of the theatres, and in connection with lectures and debates before nearly every civic and fraternal organization. The brunt of this work fell on L. B. Cheminant, Assistant Engineer, who rendered splendid service in this connection.

Descriptive and educational matter in printed form was distributed throughout all the schools both public and private. Manuals containing complete authentic data relative to the water situation, the properties to be acquired, and the financial results to be anticipated from city ownership were prepared for use of speakers. The City will take over the operation of the system as soon as the necessary legal and financial steps can be taken, probably shortly after January 1, 1929.

Bonds to be issued will be dated July 1, 1928, will bear interest at the rate of $4\frac{1}{2}$ per cent per annum, payable semi-annually, will be for \$1,000 each and will be known as "Spring Valley Bonds." Redemption will begin July 1, 1930, at the rate of \$1,000,000 per annum.

The net income of the Company during the last two years has been over \$2,000,000 annually. The Company has been paying 5 per cent or \$1,100,000 annually on \$22,000,000 bonds, dividends of \$1,400,000 annually on its stock and approximately \$300,000 annually on loans, a total of \$2,800,000. The City will pay $4\frac{1}{2}$ per cent on \$41,000,000 or \$1,845,000, thus effecting a saving in this particular of \$955,000 annually. On the other hand this will be partially offset by increased wages which will have to be paid to put these employees on a parity with others in similar employment in the City government.

It is planned that the Hetch Hetchy system and the Spring Valley system be continued as separate units until the completion of the Hetch Hetchy aqueduct which is forecast for the end of 1932. The local system will then be merged with the mountain system to provide local storage and distribution for the mountain water.

An estimate of income and expenses for the next few years has been made, projecting forward the increases and decreases of the various

items as circumstances dictate. The estimate indicates that in 1933, the year of heaviest financial stress of the combined water and power utility, due to the maximum bond interest and redemption charges, with the present water rates and power income maintained, the earnings will not only carry all operating expenses, redemption charges and interest on all the outstanding bonds, but will permit of a reduction in water rates at that time. Each succeeding year will permit a further reduction of two cents until ultimately we may be assured of a water rate less than one-half of that now existing.

In the purchase of the existing system, the major items of which the City acquires ownership are:

Over 62,000 acres of reservoir and watershed lands in San Francisco, San Mateo, Santa Clara and Alameda Counties.

Five impounding reservoirs of capacity 65,000 million gallons, the Pleasanton well system and the Sunol filter beds, capable of developing 65 million gallons daily.

All riparian and other rights necessary to protect the right to divert and use the waters from these sources.

111 miles of main aqueduct, consisting of pipe lines, conduit and tunnel, carrying the water to San Francisco, and pumping stations on the aqueducts.

All necessary rights of way for aqueducts, roads, power lines, etc.

Twenty distributing reservoirs and tanks of combined capacity of 130 million gallons, 750 miles of distributing pipes and all necessary pumping stations in San Francisco.

A complete distribution system with over 100,000 consumers.

Or, summarized, all the properties of the company used or useful in supplying water to San Francisco.

Peninsular Water Supply Investigation

The various communities in San Mateo County are growing rapidly in population. Most of them depend upon well systems drawing water from underground sources that sooner or later will become inadequate. It is only a question of time before these cities will demand more and better water than can be obtained from their present sources. The natural place for them to look will be the City's combined Hetch Hetchy and Spring Valley Water Supply.

The City Engineer is co-operating with the officials of these communities, through M. J. Bartell, Hydraulic Engineer of this department, by making a study of their present and future needs, so that in our construction we may be prepared to furnish water to such districts as may evince a desire to participate in the benefits of our water project.

Expenditures on Hetch Hetchy Project

June 30, 1928

1909 and 1910 Bond Funds Together with Amount Advanced from
General Fund Prior to Bond Issues

Code	Account	Fiscal Year 1927-1928	Total to June 30, 1928
General Expenditures			
2001	Preliminary Water Supply Investigations.....	\$	\$ 140,408.29
2002	Lands, Water Rights and Rights of Way.....	903.70	1,743,878.10
2003	Rentals to U. S. Government.....	.....	106,018.11
2004	Legal Expenses .....	.....	179,818.03
2005	Hydrography .....	.....	63,879.95
2006	City Office Administration.....	187.20	448,894.00
2007	City Office Engineering	60.00	379,824.32
2009	Taxes	7,673.84	70,129.91
2012	Unamortized Expense, Sale of Bonds.....	.....	26,877.36
A-16	City Engineer's Revolving Fund.....	.....	20,000.00
Total General Expenditures.....		\$ 8,824.74	\$ 3,179,728.07
Construction Expenditures			
1000	Hetch Hetchy R. R. (Incl. Net Operation).....	18,123.15*	2,743,349.48
2008	State Compensation Insurance, Undist'd.....	.....	4,680.67
2010	Miscl. Construction Expenditures.....	10,445.27	22,716.38
2015	C. R. C. Evaluation, P. G. & E. & G. W. P. Co.'s Properties, San Francisco.....	35,090.20	342,772.91+
2017	Wells in Sunset and Richmond Districts.....	.....	19,906.44
2018	Tourist Camp, Mather	14,333.49	52,457.16
2101	Groveland Office, Administration & Engineering	1.27*	257,964.93
2102	Groveland Hospital (Including Net Operation)....	241,965.76	118,011.27
2110	Groveland Dwellings, Less Rents.....	25.00*	68,413.77
2111	Groveland Warehouse .....	.....	9,725.96
2112	Groveland Water Supply .....	.....	33,784.65
2200	H. H. Div., O'Shaughnessy Dam & Appurtenances	578.10*	8,161,928.83
2300	Lake Eleanor Div., Eleanor Dam & Appurtenances	611.69*	391,747.22
2400	Mt. Div., Aqueduct Tunnels & Structures.....	144,180.21*	10,581,262.45
2500	Priest Div., Dam, Reg. Reservoir & Power Tunnel	32,845.50*	2,374,397.92
2600	Moccasin Div., Penstock Power House & Structures	17,205.94*	4,873,777.97
2700	Foothill Div. Tuolumne R. Crossing at Red Mt. Bar	2,971.77*	285,009.63
2800	Lower Cherry Power Development (Including Net Operation)	4,708.35*	311,985.16
2900	Early Intake Diver. Works, Dam & Appurtenances	10,368.75*	879,693.92
3000	Canyon Ranch & Mather Sawmills (Including Net Operation)	8,463.93*	147,538.30

NOTE: Asterisk (*) denotes credits. (†) See note Page 112.

**Expenditures on Hetch Hetchy Project
June 30, 1928**

1909 and 1910 Bond Issues and General Fund

Code	Account	Fiscal Year 1927-1928	Total June 30, 1928
Construction Expenditures—Continued)			
3200	H. H. Power Trans. System (Moccasin to Newark)	\$ 7,040.91*	\$ 1,787,294.18
3300	San Joaquin Division, Cost of Lands & Surveys	2,960.25	214,454.35
3400	Coast Range Division, Preliminary Surveys.....		30.00
3500	Golden Rock Ditch (less Water Sales).....		6,561.99
4000	Boarding House, Net Operation.....	2,195.91*	302,351.94
5000	Materials and Supplies	15,516.75*	38,663.46
6000	Bay Development (Newark to Pulgas), incl. Lands	6,015.80	5,952,779.88
L-73	Electric Energy from H. H. Plants (since 8/15/25)	55.13*	287.71*

Total Construction Expenditures	\$45,917.41	\$39,982,973.11
--	--------------------	------------------------

Miscellaneous Expenditures

A-12	Accounts Receivable—Miscellaneous Debtors....	\$11,614.64*	\$ 187.00
A-13	Accts. Rec., H. H. W. C. Fund (Issue of 1925)	23,012.92	94,005.17
A-18	Remittances in Transit (Deposited with Treasurer after 7/1/28)	19,786.99*	1,021.63

Total Miscellaneous Expenditures.....	\$ 8,388.71*	\$ 95,213.80
--	---------------------	---------------------

Gross Expenditures	\$46,353.44	\$43,257,914.98
---------------------------------	--------------------	------------------------

Revenues During Construction

500	Rental from Lands and Rights of Way.....	3,209.68	24,243.17
501	Sale of Water to Irrigation Districts.....		164,979.17
502	Use of Pipe Line, Bay Development.....		24,600.78
503	Miscellaneous Credits	741.31	7,932.01

Total Revenues	\$ 3,950.99	\$ 221,755.13
-----------------------------	--------------------	----------------------

Net Expenditures	\$42,402.45	\$43,036,159.85
-------------------------------	--------------------	------------------------

NOTE: Asterisk (*) denotes credits.

Expenditures on Hetch Hetchy Project
June 30, 1928

1909 and 1910 Bond Issues and General Fund

**Reconciliation of Statement of Expenditures with Consolidated
Statement of Funds**

Disbursements as Per Consolidated Statement of Funds:

1909 Bond Issue	\$ 603,033.87	
1910 Bond Issue	42,910,483.98	
General Fund	118,219.93	
Hetch Hetchy Operative Revenue Fund	\$1,955,506.19	
Transfer to Bond Interest Fund.....	620,000.00*	1,335,506.19 \$44,967,243.97

Accounts Taken Into Expenditures as of June 30, 1928:

(not taken up by Auditor until after July 1, 1928)

Purchase Order Liability		
Accts. Payable, H. H. Power Operative Fund.....	34,640.58	
Accts. Payable, Employees Payroll (June).....	45.05	
Accrued on account of Compensation Ins. Prem...	.88	34,686.51
		<hr/>
		\$45,001,930.48

Receipts Used as Reduction of Expenditures:

Operation of Hetch Hetchy R. R.....	1,380,876.87	
Sale of Power, Lower Cherry Power Dev.	386,338.54	
Sale of Water	166,324.50	
Use of Pipe Line, Bay Dev. (S. V. W. Co.)	24,600.78	
	<hr/>	
Miscellaneous	4,093.31	1,962,234.00
Non-Cash Credits used as reduction of Expen- ditures	3,536.63	1,965,770.63
	<hr/>	<hr/>

Net Expenditures as Per Detailed Statement (Page 111)..... \$43,036,159.85

Note: The foregoing expenditures include the sum of \$342,772.91 (Account 2015, Page 110) which was paid out of the Hetch Hetchy Operative Revenue Fund for valuation of Pacific Gas and Electric Company's and Great Western Power Company's Plants. This charge is not a true Hetch Hetchy Project expenditure and should be deducted when calculating the actual costs of the project.

NOTE: Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1928
1925 Bond Fund

Code	Account	Fiscal Year 1927-1928	Total to June 30, 1928
Foothill Division			
2700	Division Administration & Engineering.....	\$ 45,430.05	\$ 128,887.59
2701	Preliminary Investigations & Surveys.....	129.63	31,837.79
2702	Field Engineering and Inspection.....	57,427.10	109,315.63
2703	Camps	37,311.14*	256,444.94
2704	Roads, Trails and Tramways	7,845.06	166,044.65
2705	Adits	303.98*	8,420.59
2706	Shafts	15,917.27	70,512.79
2707	Aqueduct Tunnels	1,787,654.55	4,276,999.90
2710	Aqueduct Diversion Dam & Appurtenances....	9,766.71	35,823.70
2711	Moccasin Creek Diversion Dam.....	77.09	77.09
2712	Moccasin Creek Diversion Conduit.....	62,593.88	62,754.69
2713	Moccasin Crushing Plant	57,363.31	85,184.76
2714	Miscellaneous Jobbing and Sales Account.....	10,950.56	13,081.84
2716	Division Machine Shops (Incl. Operation).....	4,481.33*	26,090.45
2717	Division Warehouse (Incl. Operation).....	7,369.67*	4,663.53*
2718	Lands & Rights of Way.....	12,622.26	56,132.73
2719	Power Transmission Line for Constr. Purposes	9,490.88	57,759.84
2720	Div'n. Administration Buildings & Equipment	1,130.87	54,337.21
2721	Division Hospital (Incl. Operation).....	55,226.22	37,832.82
2722	Materials and Supplies	83,270.70*	259,008.60
2723	Division Misc. Shops & Equip. (Incl. Oper'n.)	3,193.88	39,852.02
2724	Division Garage Equipment (Incl. Operation)	6,252.66*	14,253.09
2726	Division Communication System	463.95	16,904.35
2727	Camp Operation (Incl. Boarding Houses).....	32,884.24	89,652.66
2792	General Administration	37,907.59	103,209.27
2793	General Engineering	25,381.88	75,115.06
2794	Law Expenses During Construction.....		5,431.38
2797	Miscellaneous Construction Expenditures.....	897.29	1,133.19
L-73	Electric Energy from Hetch Hetchy Plants....	111,728.89*	134,358.13*
Total		\$1,983,635.90	\$5,943,076.97

San Joaquin Division

3301	Preliminary Investigations & Surveys.....	656.65	1,098.75
Total		\$ 656.65	\$ 1,098.75

Coast Range Division

3400	Division Administration & Engineering.....	19,656.43	21,914.30
3401	Preliminary Investigations & Surveys.....	7,299.64	52,569.90
3402	Field Engineering and Inspection.....	14,717.18	15,916.99
3403	Camps	153,842.20	169,812.94
3404	Roads, Trails and Tramways.....	47,447.73	68,053.12
3406	Shafts	419,662.87	426,475.64
3407	Aqueduct Tunnels	20,460.23	20,460.23
3414	Miscellaneous Jobbing and Sales Account.....	1,712.92	1,712.92

Code	Account	Fiscal Year 1927-1928	Total to June 30, 1928
Coast Range Division—(Continued)			
3415	Equipment Rentals	772.50*	772.50*
3416	Division Shops & Equipment (Incl. Operation)	1,699.51	20,479.16
3417	Division Warehouse (Incl. Operation).....	16,069.39	16,983.93
3418	Lands and Rights of Way.....	32,955.96	39,785.43
3419	Power Transmission Line for Constr. Purposes	202,601.62	211,796.33
3420	Div'n. Administration Buildings & Equipment	1,378.10	1,459.70
3421	Division Hospital (Incl. Operation).....	940.63	883.64
3422	Materials & Supplies	104,741.89	153,971.60
3424	Division Garage Equipment (Incl. Operation)	4,636.99*	986.74*
3426	Division Communication System.....	18,562.37	20,230.27
3427	Camp Operation (Incl. Boarding Houses).....	16,876.33	17,061.00
3492	General Administration	11,899.46	12,101.31
3493	General Engineering	19,563.35	26,587.77
3494	Law Expenses During Construction.....	318.10	325.60
3497	Miscellaneous Construction Expenditures.....	279.10	563.24
L-73	Electric Energy from Hetch Hetchy Plants....	5,394.74*	5,394.74*
Total		\$1,101,880.78	\$1,291,991.04
General and Miscellaneous			
A-12	Accounts Receivable, Miscellaneous Debtors..	2,717.02*	2,333.69
A-13	Accts. Receivable, H. H. Power Operative Fund	835.88*	
A-18	Remittances in Transit	101,418.04	125,429.67
A-25	Unamortized Expense on Bonds Sold.....	1,150.00	6,461.00
A-26	Prepaid Construction Expend.	98,872.49*	
Total		\$ 142.65	\$ 134,224.36
Total Net Expenditures		\$3,086,315.98	\$7,370,391.12

**Reconciliation of Statement of Expenditures with Consolidated
Statement of Funds
1925 Fund**

Disbursements as Per Consolidated Statement of Funds		\$6,866,726.68
Accounts taken Into Expenditure as of June 30, 1928: (not taken up by Auditor until after July 1, 1928)		
Purchase Order Liability	\$ 91,008.51	
Accounts Payable, Due on Contracts 113C & E.....	32,728.95	
Accounts Payable, 1910 Water Construction Fund....	94,005.17	
Accounts Payable, Hetch Hetchy Power Operative Fund	1,250.36	
Accounts Payable, Miscellaneous Creditors.....	4,019.83	
Employees Payroll	101,091.83	
Accrued on Contracts 113C & E, Progress Estimate (10 per cent withheld in accordance with Contract)	171,457.79	
Accrued on account of Compensation Ins. Premiums	8,102.00	503,664.44
Net Expenditures as Per Detailed Statement.....		\$7,370,391.12

NOTE: Asterisk (*) denotes credit.

**Expenditures on Hetch Hetchy Project
June 30, 1928**

Hetch Hetchy Operative Revenue Fund

Total Receipts		\$1,967,969.00
Transferred to Bond Interest Fund.....	\$620,000.00	
Transferred to P. G. & E. & G. W. P. Co.'s evaluation	342,772.91	
Transferred to H. H. 1910 Water Construction Fund....	992,733.28	1,955,506.19
Balance available, June 30, 1928.....		12,462.81

**Hetch Hetchy Power Operative Fund
Condensed Balance Sheet**

	From	1909 & 1910 Bond Issues and General Fund	Total per Gen'l Ledger June 30, 1928
Assets and Other Debits	Operation		
Investment in Fixed Capital.....	\$ 220,817.00	\$25,337,374.87	\$25,558,191.87
Current and Accrued Assets.....	1,749,918.28	21,315.85	1,771,234.13
Special Funds (Depreciation).....	368,036.60		368,036.60
Deferred Debits	206,589.24*	1,569,809.38	1,363,220.14
Total Assets and Other Debits....	\$2,132,182.64	\$26,928,500.10	\$29,060,682.74
Liabilities and Other Credits			
Capital and Long Term Debt.....	\$2,098,361.96*	\$26,928,500.10	\$24,830,138.14
Current and Accrued Liabilities.....	871,582.78		871,582.78
Reserve for Depreciation	382,429.64		382,429.64
Appropriated Surplus	1,737,566.01		1,737,566.01
Additions and Better- ments	\$ 201,266.01		
Sinking Funds Retire- ment of 1910 Bonds....	1,536,300.00		
Unappropriated Surplus	1,238,966.17		1,238,966.17
Profit and Loss after			
Comparison Chgs.	969,448.53		
Taxes Chgd. for Com- parison	409,558.22		
Revenues credited for			
Comparison	140,040.58*		
Total Liabilities & Other Credits..	\$2,132,182.64	\$26,928,500.10	\$29,060,682.74

NOTE: Asterisk (*) denotes deductions.

Expenditures on Hetch Hetchy Project
June 30, 1928

Hetch Hetchy Power Operative Fund
Income Statement

Income from Operating Properties

	Fiscal Year 1927-1928	Total to June 30, 1928
Operating Revenues:		
Moccasin Power House	\$8,617,906.96*	\$24,539,753.84
Early Intake Power House	65,570.52	156,675.22
Total Operating Revenues	\$8,683,477.48	\$24,696,429.06
Operating Expenses:		
Production	\$ 148,909.62	\$ 427,647.44
Transmission	27,775.00	70,108.00
Distribution		144.83
Commercial Department	6,296,447.08	17,928,922.36
General & Miscellaneous	209,884.06	545,050.11
Total Operating Expenses	\$6,683,015.76	\$18,971,872.74
Net Operating Revenue	\$2,000,461.72	\$ 5,724,556.32
Deduct Taxes Assignable to Operations	5,695.22	11,218.91
Net Operating & Gross Income	\$1,994,766.50	\$ 5,713,337.41
Deductions from Gross Income		
Interest on Long Term Debt	\$ 852,606.00	\$ 2,517,111.00
Miscellaneous Interest Deductions	10,081.97	41,904.28
Amortization of Debts Dis. & Expense	61,842.18	177,789.95
Total Deductions	\$ 924,530.15	\$ 2,736,805.23
Net Income	\$1,070,236.35	\$ 2,976,532.18
Disposition of Net Income		
Approp. for Additions & Betterments	\$ 109,702.25	\$ 201,266.01
Approp. for Retirement of 1910 Bonds	512,100.00	1,536,300.00
Total Appropriations	\$ 621,802.25	\$ 1,737,566.01
Balance for Actual Surplus	\$ 448,434.10	\$ 1,238,966.17
Charter Requirements for Comparison		
Add. Revenue Chgd. H. H. W. S. Constr.	82,202.92	140,040.58
	\$ 530,637.02	\$ 1,379,006.75
Deduct Taxes	147,424.42†	409,558.22
Balance After Comparison Charges	\$ 383,212.60	\$ 969,448.53

ADJUSTMENT MADE AFFECTING REPORTS PREVIOUSLY RENDERED

*\$34,975.84 deduction made in 1927-1928 applies to 1926-1927.

†\$ 4,779.18 deduction made in 1927-1928 applies \$482.43 to 1925-1926, \$4,296.75 to 1926-1927.

Expenditures on Hetch Hetchy Project
June 30, 1928
Addenda

Interest Received on Bay Development Expenditures

	Principal	Interest
April 18, 1922, to May 31, 1924.....		\$58,232.05
June 1, 1924, to April 17, 1925.....	\$4,796,086.43	170,451.54
Transferred to 1910 Bond Interest Fund.....		\$228,683.59
July 1, 1925, to June 30, 1929.....	\$5,000,000.00	
Transferred to 1910 Bond Fund.....		\$883,390.64

**Interest Received on Accounts Receivable and
Surplus Funds Invested**

July 1, 1919, to June 30, 1926 (1910 Bond Fund)		
Credited to 1910 Bond interest Fund.....		\$2,910,471.16
November 1, 1918, to June 30, 1924 (Hetch Hetchy Operative Revenue Fund)		
Accounts Receivable Hetch Hetchy Railroad.....	\$	19,006.67
Surplus Funds Invested		5,735.00
Credited to Hetch Hetchy Operative Revenue Fund.....	\$	24,741.67

Receipts from Water Crop

Waterford Irrigation District	\$	750.00
Turlock Irrigation District		90,000.00
Modesto Irrigation District		74,229.17
	\$	164,979.17
Sales from Golden Rock Ditch.....		1,345.33
Credited to Hetch Hetchy Operative Revenue Fund.....	\$	166,324.50

Receipts from Use of Pipe Line—Bay Development

September to December, 1925:		
Credited to Hetch Hetchy Operative Revenue Fund.....	\$	24,600.78

HATCH KETCHY PROJECT
CONSOLIDATED STATEMENT OF FUNDS -- JUNE 30, 1928

	Bond Issues			General Fund	H.C. Operative Revenue Fund	Hatch Ketchy Power Operative Fund		TOTALS
	1909	1910	1925			Operative	Depreciation	
RECEIPTS:								
Par Value of Bonds Sold	\$ 600,000.00	\$ 45,000,000.00	\$ 10,000,000.00					\$ 56,600,000.00
Add Premiums, Sale of Bonds	3,060.00	11,348.00	107,211.00					121,609.00
Deduct Discount, Sale of Bonds		2,980,326.55						2,980,326.55
Net Proceeds, Sale of Bonds	603,060.00	42,021,021.45	10,107,211.00					52,741,282.45
Advanced from General Fund Transferred from 1909 & 1910 Funds to General Fund	16.13*	52.78*		118,151.02				118,151.02
Interest Earned on Funds In-Advance Payments by Spring Valley Water Company		883,390.64		68.91	5,735.00			5,735.00
Operation of Hatch Ketchy Railroad					1,380,876.87			883,390.64
Sale of Power, Lower Cherry Power Development					386,338.54			1,380,876.87
Use of Water					166,324.50			386,338.54
Use of Pipe Line, Bay Development					24,600.78			166,324.50
Miscellaneous					4,093.31			24,600.78
Operating Revenues					6,649,189.49			4,093.31
Depreciation Reserve, Transferred from Operative					418,749.00*			6,649,189.49
Total Receipts	603,033.87	42,914,359.21	10,107,211.00	118,219.93	1,967,969.00	6,130,440.49	418,749.00	62,259,982.60
DISBURSEMENTS								
For Construction of Project and Operation of Utilities, except depreciation expense, which is shown as a transfer								
For Charges to Depreciation Reserve	603,033.87	42,910,483.98	6,866,726.68	118,219.93	992,733.28	869,000.11		52,360,197.85
For Bond Interest, Transferred to Bond Interest Funds						50,712.40		50,712.40
For Bond Redemptions, Transferred to 1910 Bond Redemption Fund					620,000.00	2,915,068.00		3,535,068.00
For Calif. Railroad Commission						827,932.00		827,932.00
For California Electric & Gas Plants in San Francisco					342,772.91			342,772.91
Total Disbursements	603,033.87	42,910,483.98	6,866,726.68	118,219.93	1,956,606.19	4,612,000.11	50,712.40	57,116,695.16
CASH BALANCES, JUNE 30, 1928		3,875.33	3,240,484.32		12,462.61	1,618,440.38	368,036.60	5,143,299.44

* Indicates Deductions

Contractual Liabilities, Hetch Hetchy Water Construction Fund

Contr. No.	Name of Contractor	Object of Expenditure	Amount of Contract	Amount Due June 30, 1928
		Construction of Aqueduct Tunnels, Foothill Division		
113-C	A. Guthrie & Co.	Rock River & Oakdale Sections	\$1,257,952.50	\$382,059.89
113-E	T. E. Connolly & J. M. DeLuca	Brown Adit Section	779,745.00	141,712.87
Totals			\$2,037,697.50	523,772.76
Add: Amounts deducted from payments to contractors account of labor and material furnished by City:				
	Contract No. 113-C		\$ 197,613.59	
	Contract No. 113-E		125,738.90	
Deduction made from 113-E account of overbreak in tunnel excavation			4,270.42	327,622.91
Deduct: Allowances made account of placing permanent timber:				\$851,395.67
	Contract No. 113-C		476.78	
	Contract No. 113-E		260.08	736.86
Balance as per Auditor, June 30, 1928				\$850,658.81



DONALDSON PRINTING CO.
543 CLAY STREET



